Elements of Foods and Nutrition

Mary T. Dowd · Alberta Dent

Second Edition

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Elements of Foods and Nutrition

Basic seven foods. Courtesy, Sealtest Laboratory Kitchen.

Elements of Foods and Nutrition

MARY T. DOWD, Formerly Teacher of Household Science, Washington Irving High School, New York City

ALBERTA DENT, Formerly Associate Professor of Home Economics, New Jersey College for Women

SECOND EDITION

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PREFACE

The eight years since the first edition of this book was published have been significant ones in the science of nutrition. The study of certain phases of the subject, particularly minerals and vitamins, has provided much new information regarding the sources and functions for health of nutrients recognized earlier and also about newly discovered nutritional substances. The national nutrition conference in 1941 focussed attention on the relation of nutrition to health and aroused a greater demand for education in nutrition. New techniques for determining nutritional status have been devised. Especially significant among these new developments has been the increasing recognition of the importance of better nutrition as a factor in general well-being. It is, therefore, more vital than ever to know what the body needs, what to eat to supply these needs, and how to select, prepare, and serve the necessary foods so that good food habits will be established.

This second edition has been practically rewritten. In accordance with present-day educational thinking, the form has been changed to that of unit organization, with each unit complete in itself but related to the others. The scope of the subject matter has been enlarged to incorporate new developments and to add more information about certain topics less thoroughly covered in the first edition. The section on vitamins has been considerably enlarged and more information has been added concerning child and family nutrition and consumer buying of foods. Throughout the book more applications of scientific facts have been suggested. The approach—that of the health needs of the individual and their application to the family group—remains the same, as does the aim—that of guidance in the acquisition of necessary knowledge concerning food and nutrition and the establishment of good food habits.

In organization, content, and approach, the book provides an introductory course in foods and nutrition for either the senior high school student or the older person whose school experience did not include much training in health and nutrition or who may wish a less technical but up-to-date presentation of these

subjects. Nutrition is a science in its own right, and in this book the authors aim to present the basic scientific principles underlying the choice of foods for health and the selection and preparation of food. Almost no one can evade the necessity of making individual decisions concerning his own food; many have to face, in addition, the problem of preparing food for themselves or family groups. Success, in both cases, depends upon an adequate knowledge of basic principles.

This volume, supplemented by a satisfactory cookbook for the practical part of the work, may be used as a textbook in any senior high school course in foods or nutrition. It is particularly well fitted for courses where much work of a practical nature is impossible because of limitations of time or equipment.

In addition to its use in home economics classes for boys and girls, the book may be used in biology and hygiene classes to present the part of each course which deals with nutrition. It also provides a textbook for small study groups or classes of adults organized under the Red Cross or local or state nutrition services.

Questions or activities or both are included at the end of each chapter, both to focus attention on the important features of the chapter and to relate the material of the text to the everyday life and problems of the users. These have been increased and modernized in the present edition. They are not intended to be inclusive and may be supplemented by those suggested by the teacher or arising during the study from actual experiences of class members. In a number of activities availability of gram scales for use by the students or a set for demonstrations by the teacher is presupposed. Certain activities offer suggestions for exhibits on nutrition.

At the end of each chapter reference readings in textbooks which are generally available in the schools and also food and nutrition books of a less technical type are also presented. The high school texts are so indicated. Here again, the teacher will no doubt wish to supplement these lists with other available material which she has found useful.

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MARY T. DOWD
ALBERTA DENT SHACKELTON

January, 1945.

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INTRODUCTION

NUTRITION AND HEALTH

CHAPTER I

RELATION OF NUTRITION TO HEALTH

Fitness, Health, and Nutrition. Physical and mental fitness is considered to be a basic right and necessity in the life of every individual today more than ever before. During the entire life span it is a prime requisite for a person's fullest development, maximum efficiency, and most satisfactory fulfillment of a place in life. Its attainment is an end well worth striving for and is no less an asset than accumulated material acquisitions. For many persons, it is their only asset when it comes to earning a living.

To a certain extent, one's fitness depends upon heredity. To a great extent, it is conditioned by one's general health and nutrition. Good health is basic to physical and mental health. Good nutrition is basic to good health.

Because standards for fitness vary from person to person, it becomes necessary to recognize those which are accepted by experts in the field of health and nutrition in our modern world. There is a great difference between what might be termed passive and active fitness or between that state of fitness which allows one to indulge only in the minimum necessary activities and that state which allows not only this but an enjoyment of life to the fullest as well.

How Fit Is America? The early months of the year 1941 will long be remembered for many reasons. America was engaged in rapidly expanding its defense program. As this program advanced, it became apparent that food and nutrition were to become as important as metals and munitions in the mobilization of the country's total resources. How surprised we were to learn then that many of the young men being examined for military service (about one-third of those examined to date) were unfit for general military service. More surprising was the news that

many rejections, estimated as one-third of the total number, were the result of nutritional defects. Could it be that the youth in America in 1941 were no better off nutritionally, after a long period and many vital discoveries in the field of nutrition study, than the youth who had been part of the armed forces during World War I? If such were the case, where could a more plausible cause be found than in America's food and nutrition habits?

For some years previous to 1941, the Bureau of Home Economics (now called the Bureau of Human Nutrition and Home Economics) of the United States Department of Agriculture had been studying dietary habits of representative groups in various parts of the United States. These studies indicated that America had not been eating as well as it might have been, since approximately three-fourths of the people did not have diets that could be considered, by any reasonable standards, to be good. Some persons failed to eat adequately because of insufficient income, some because they did not know how to select foods for good nutrition, and some (far too many) because they were not sufficiently interested in their own nutritional well-being. Inadequate diets sooner or later result in lower fitness, poor health, and poor nutrition.

That poor nutrition is all too common among children in the United States has been shown in studies of the dietary habits and the presence of nutritional deficiencies among the school population. A recent study, by the Milbank Memorial Fund, of the dietary habits of a group of high school pupils indicates a need for considerable improvement in such habits. Of the two thousand or more pupils whose dietary habits were evaluated, 74 per cent consumed fewer calories than the recommended daily allowances, 44 per cent consumed less protein, 72 per cent less calcium, 64 per cent less iron, 65 per cent less vitamin A, 53 per cent less thiamin, 70 per cent less riboflavin, and 58 per cent less ascorbic acid. Further observations of the same pupils showed that nearly all of them had one or more mild deficiency diseases that could be diagnosed by special tests.

Factors Which Affect Good Health and Nutrition. Figure 1 indicates that many factors affect one's state of health and that the same factors which promote good nutrition also promote good health.

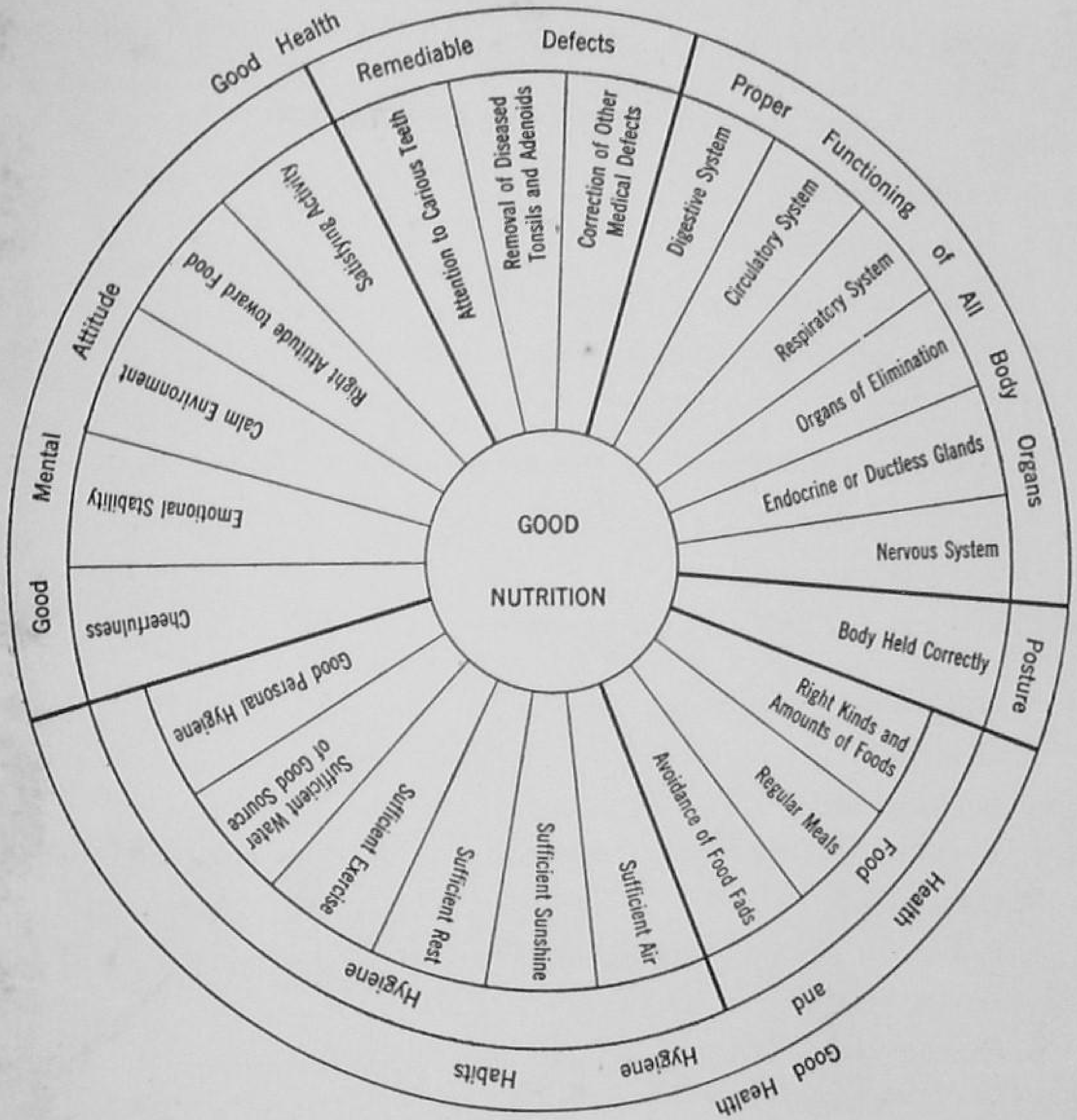

FIG. 1. Factors in health and nutrition.

Personal Health Standard and Scale. There are three ideals or standards of health for the individual.*

1. The ideal that one has of *health,* the perfect health that one imagines and would like to have. This is never wholly attainable.
2. The *health* that one actually has. This is often far below the possible and the practicable for the individual.
3. The *health* that one might have with the knowledge, appreciation, and realization of health that are reasonably available for the individual.

A personal health survey or inventory should show the relation of one's health to an optimum standard for one's type (age, occupation, etc.). The health scale on pages 4–5 may be used to

* T. D. Wood, *Personal Standard and Health Scale,* Bureau of Publications, Teachers College, Columbia University. Courtesy, Bureau of Publications.

TABLE 1

Score Card of Factors Which Promote Health *

I. Indications of health	10		
A. Posture erect and easy		2	
B. Skin smooth, clear, and pinkish in color		1	
C. Weight and distribution of flesh correct for body structure		2	
D. Good appetite		1	
E. Absence of overfatigue after reasonable work and exercise		1	
F. Freedom from pain		1	
G. Freedom from undue worry		1	
H. Enjoyment of both work and recreation		1	
II. Factors promoting health	90		
A. Cleanliness		2	
1. Daily bath			1
2. Teeth kept clean by effective brushing at least twice daily			1
B. Dress		3	
1. Clothing which protects the body from cold, heat, or rain			1
2. Clothing chosen for comfort as well as style			2
C. Exercise, regular, vigorous, preferably out-of-doors, amounting to at least ½ hour daily		3	
D. Rest		6	
1. Sufficient sleep at regular hours (for most persons, probably 8 to 9 hours daily)			3
2. Thorough relaxation, at least 15 minutes during the day			3
E. Recreation		5	
1. One to two hours daily for social recreation, reading, a hobby, etc.			3
2. One or two evenings each week free from regular work			1
3. One entire day each week free from regular work			1
F. Mental attitude		8	
1. Cheerfulness			2
2. Sense of humor			2
3. Emotional stability			2
4. Satisfying philosophy of life			2

* J. S. Wilmot and M. Q. Batjer, *Food for the Family*, J. B. Lippincott Company, 1938. Pages 4–5. Courtesy, J. B. Lippincott Company, Publishers.

TABLE 1—*Continued*

SCORE CARD OF FACTORS WHICH PROMOTE HEALTH

G. Regular health examination to prevent or overcome illness	21		
1. Tendency to colds		3	
2. Frequent digestive disturbances		2	
3. Defects		16	
a. Eyes			2
b. Ears			2
c. Tonsils			2
d. Teeth			2
e. Heart			2
f. Lungs			2
g. Glands of internal secretion			2
h. Feet			2
H. Vaccination or inoculation and freedom from susceptibility to contagious disease	6		
1. Smallpox		2	
2. Diphtheria		2	
3. Typhoid		2	
I. Regular bowel movement at least once daily without the assistance of a laxative	3		
J. Diet (for adults)	33		
1. Eating habits		9	
a. Regularity of meals (3 daily)			3
b. No food between meals unless prescribed by a physician			2
c. Avoidance of dieting to reduce except on the advice of a physician			2
d. Avoidance of patent products in order to reduce			2
2. Foods to be included in the diet		24	
a. Milk: 1 pint daily, as a beverage or in food (minimum ½ pint)			3
b. Fruits: at least 2 daily, one preferably fresh (minimum 1)			3
c. Vegetables: at least 3 daily, one starchy, one green or yellow			3
d. Cereals: at least as much of whole grain cereal products as of refined			3
e. Meat, poultry, or fish: one serving daily			3
f. Eggs, cheese, or dried legumes: one serving daily			3
g. Fats and sweets: use sparingly			3
h. Water: at least 2 quarts daily			3
	100		

rate one's self on certain factors important in the promotion of health.

Nutrition: A Science Important to Health and Fitness. Nutrition, or the science of nourishing the body, is a relatively new science. Human beings have always been interested in the consumption of food, its use by the body, and effects in the body. The development of chemistry, around the late 1600's, was necessary before any scientific explanation could be advanced. As the study of chemistry progressed and furnished information

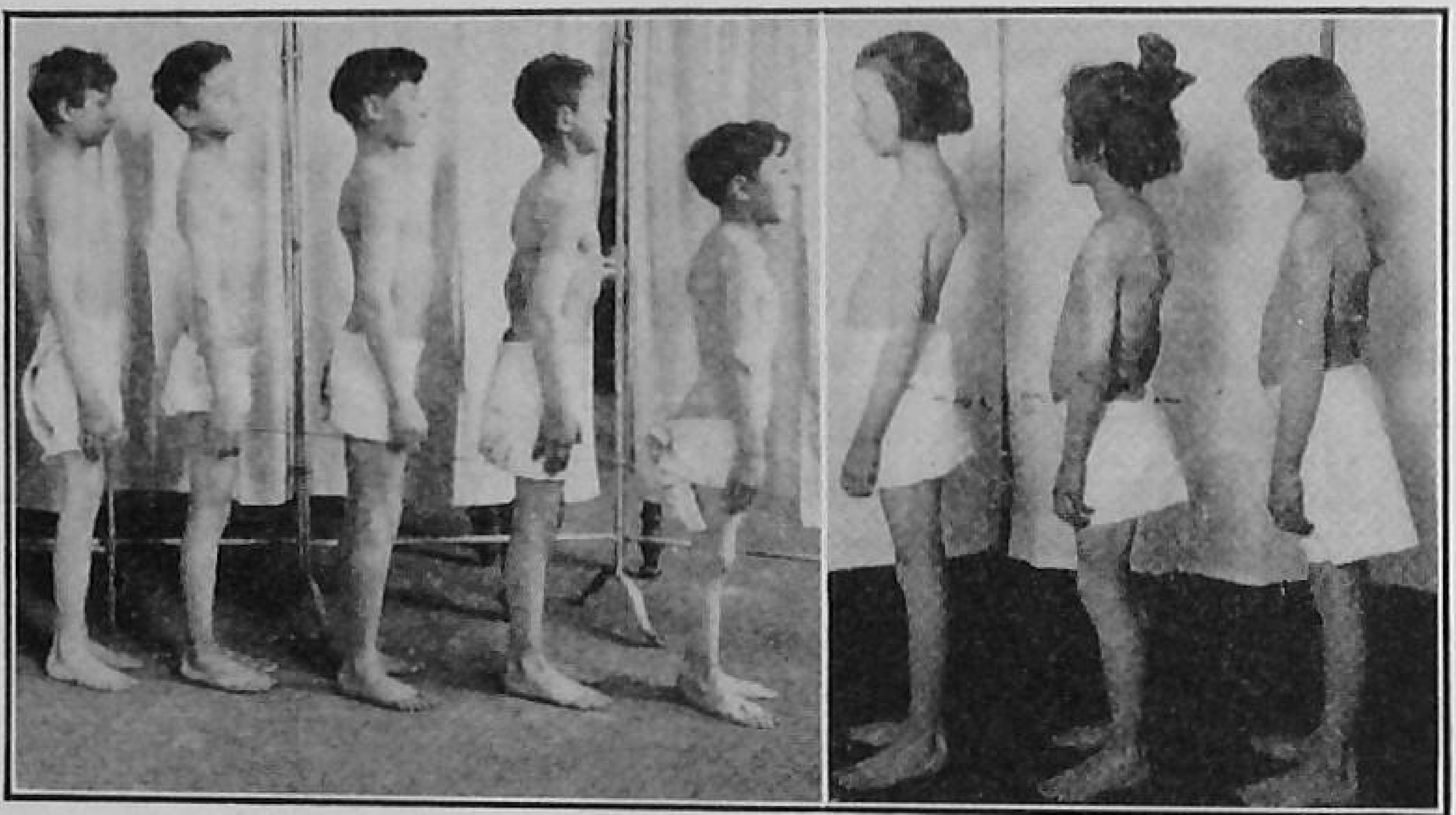

FIG. 2. The size and shape of the body are affected by nutrition. Courtesy, Elizabeth McCormick Memorial Fund.

on air as an essential to life and on the now well-known gases of respiration, it was not long before the relation of respiration to the use of food by the human body was recognized. In the late 1700's Lavoisier observed that substances burned in the body in a manner similar to the burning of a fuel in a flame; today he is known as the Father of the Science of Nutrition. He began the studies which developed into later nutrition investigation.

Thus, by the beginning of the present century, the science of nutrition was primarily concerned with the question of energy (calories), the total needs of human beings for energy, and the comparative values of the three organic foodstuffs: carbohydrates, fats, and proteins. Very shortly thereafter significant differences were noted among the proteins from various sources, and a new era of nutrition study (protein investigation) developed. Minerals and vitamins were subsequently discovered, becoming known as the "little things in nutrition."

Today there are still new discoveries being made concerning energy, protein, minerals, and vitamins, as well as the ways they interact. The nutrition story is far from complete and promises many dramatic and important new discoveries.

It is generally agreed that the advances and achievements that have been made in the new science of nutrition during its

FIG. 3. Rickets—a nutritional deficiency disease. From L. Cooper, M. Barber, and H. Mitchell, *Nutrition in Health and Disease for Nurses,* 9th Edition. Courtesy, J. B. Lippincott Company.

relatively short period of existence, and, more particularly, in recent years, are among the most outstanding in medical science. "They have made it clear that the food an individual eats fundamentally affects his health, strength, stamina, nervous condition, morale, and mental functioning. It is of paramount importance in the normal growth, development, and health of children." *

Food affects the size and shape of the body. While heredity determines the maximum limits of stature of any individual, environment allows or prevents the attainment of this maximum stature. It has been noted that children of certain European

* *Proceedings, National Nutrition Conference for Defense,* May 1941, page 230.

and Oriental races reared in this country, where the rearing appears to differ from that of their native land only in the kind of food eaten, attain a height of about two inches above the average of children raised in their native lands. Students entering college today are taller than their parents who entered college thirty years ago, partly as the result of the application of the new nutrition knowledge.

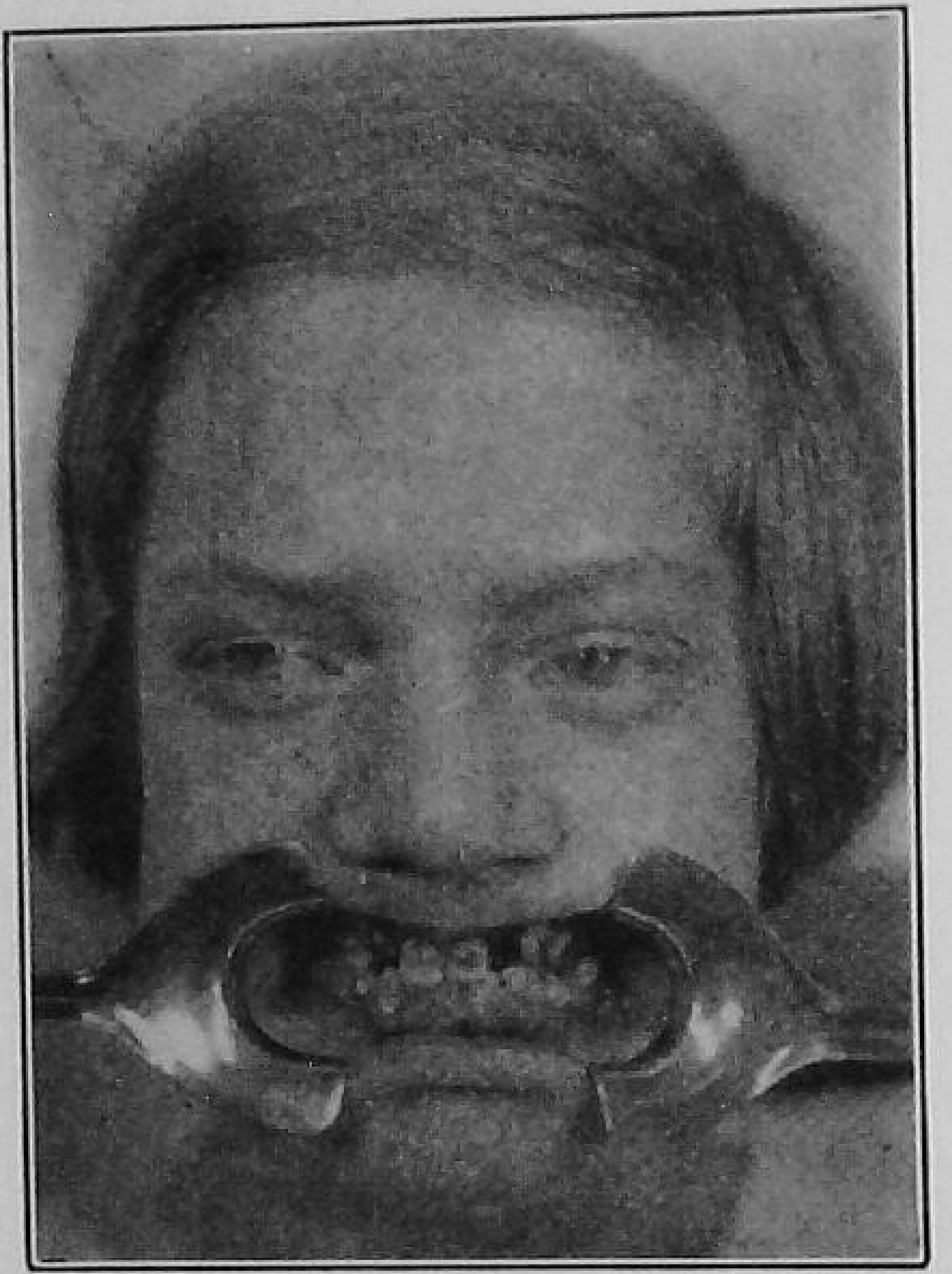

FIG. 4. Quality of teeth is affected by nutrition. Courtesy, Forsythe Dental Infirmary, Boston.

If the body becomes stunted through lack of proper food during the growing period, there will never come a time in later life when this condition can be remedied. Such a deficiency may also be the cause of poor posture, certain bone deformities, narrow chest, poorly developed teeth, and teeth badly placed in the jaws. The quality of the body is likewise affected by the food eaten, as seen in poorly calcified teeth, soft body fat in place of firm flesh, too brittle or, on the other hand, too soft and pliable bones, and rough hair and skin resulting from a diet deficient in one or more respects.

General resistance to disease of one kind or another, as well as resistance to such specific nutritional deficiency diseases as anemia, scurvy, beriberi, and the like, is improved by a food supply that is abundant in kind and amount. It has been proved beyond a doubt that, when additional amounts of the protective foods are added to what appear to be already adequate diets, greater health, stamina, and efficiency are experienced by persons who consider themselves perfectly well.

One of the striking and more recently recognized ways in which the newer knowledge of nutrition exerts some of its benefits is in the increase of the average length of life. This increase represents the addition of extra years to old age and also causes life

to be lived on a higher plane, particularly during what is popularly known as the "prime of life."

Improved nutrition even holds a promise for increased mental efficiency. Ability to do good and sustained mental work is, in no small measure, conditioned by physical well-being. A correlation between good physical condition and concentration and mental accomplishment is commonly observed in children by their teachers. Many times a so-called problem child with his restlessness, irritability, and lack of concentration responds to a change in diet and shows marked improvement in behavior.

Figures 2 to 4 illustrate the ways nutrition affects growth, shape, and condition of the body and lowered resistance to deficiency diseases. Contrast these with the evidences of good nutrition shown in Figure 5.

Adequate and Optimum Nutrition. Today it is realized that adequate nutrition is not synonymous with optimum nutrition. As previously stated, repeated observations prove that greatly improved nutritional status and well-being can be accomplished when increases are made in various nutrients in diets which are already considered adequate and which produce what appear to be superior nutrition and health. The abundant diet was formerly thought to be the one which furnished the greatest number of calories. It has been defined by Dr. McLester * more recently as that "diet which, both in sickness and health, will meet but not exceed a person's caloric needs and which is designed to provide as far as possible in liberal excess of today's calculated requirements all nutritive essentials, notably protein and vitamins." Calcium, according to many investigators, should be added to this list.

The adequate diet supplies the minimum requirements of each nutrient plus a reasonable margin of safety, usually figured at about 50 per cent. The optimum diet provides a liberal excess of nutrients beyond the minimum figures.

Criteria of Good Nutrition. Weight is a popularly used, but not an entirely reliable, indication of good nutrition and should be used in relation to other accepted standards of nutritional status, never alone. Weight tables, based on height, age, and

* J. S. McLester, "The More Abundant Diet," *Journal of the American Dietetic Association*, 14, 1, 1938.

sex, are most frequently used. These are not considered to give a true picture of the state of one's nutrition, especially when used to judge problems during the period of growth. More desirable tables take into account not only factors of sex, height, and age, but also the nature of the body framework and body structure, or the linear (slender) and the lateral (stocky) types.

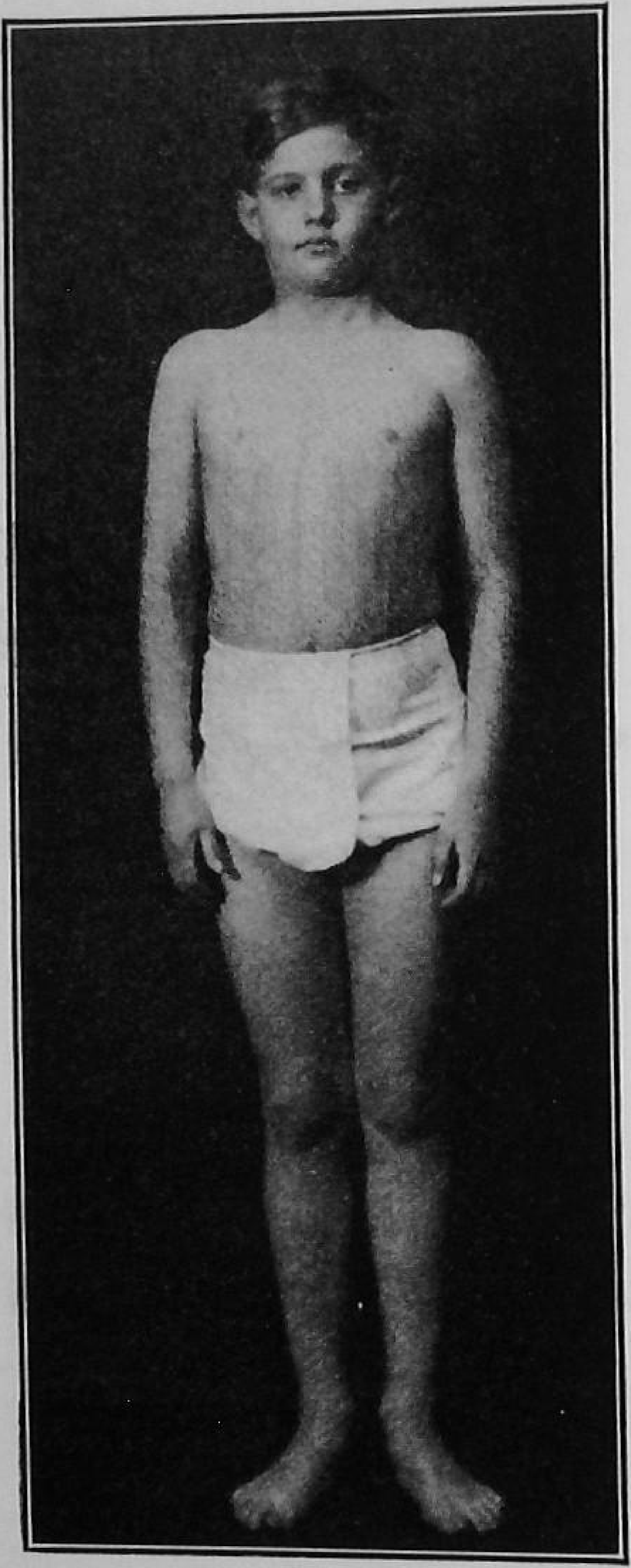

Fig. 5. Characteristics of good nutrition. From L. J. Roberts, *Nutrition Work with Children*. Courtesy, University of Chicago Press and Dr. Roberts.

It is suggested by some authorities that the desirable, or average, body weight should never be considered as a specific number of pounds but rather a zone, the upper limit of which is the average figure plus 20 per cent and the lower limit of which is the average minus 7 per cent. Marked deviations from such zones might then be considered to indicate faulty nutrition: neither overweight nor underweight is consistent with good nutritional status.

More recently, width-weight standards have come to be preferred to those of height-weight. In other words, account is taken not only of the weight for the height, age, and sex but also of some measurement of the body build of the individual. The width-length index has been thus used, the bi-iliac diameter or width of the pelvic crest being considered the most important and least variable measurement usable as an index

of body build and not variable with posture or with respiration. The width of the body in relation to standing height is thus expressed and the weight is estimated for the build.

Tables 2–7 are some of those commonly used to determine what can be considered the standard, or average, weight for an individual of given height, age, and sex.

TABLE 2

Height-Weight-Age Table for Boys from Birth to School Age *

Height (inches)	Average Weight for Height (pounds)	1 Mo.	3 Mos.	6 Mos.	9 Mos.	12 Mos.	18 Mos.	24 Mos.	30 Mos.	36 Mos.	48 Mos.	60 Mos.	72 Mos.
20	8	8											
21	9½	9	10										
22	10½	10	11										
23	12	11	12	13									
24	13½	12	13	14									
25	15	13	14	15	16								
26	16½		15	17	17	18							
27	18		16	18	18	19							
28	19½			19	19	20	20						
29	20½			20	21	21	21						
30	22			22	22	22	22	22					
31	23				23	23	23	23	24				
32	24½				24	24	24	25	25				
33	26					26	26	26	26	26			
34	27						27	27	27	27			
35	29½						29	29	29	29	29		
36	31							30	31	31	31		
37	32							32	32	32	32	32	
38	33½								33	33	33	34	
39	35								35	35	35	35	
40	36½									36	36	36	36
41	38										38	38	38
42	39½										39	39	39
43	41½										41	41	41
44	43½											43	43
45	45½											45	45
46	48												48
47	50												50
48	52½												52
49	55												55

Weight is stated to nearest pound, height to nearest inch, age to nearest birthday. Figures represent weight in pounds; weights are net up to and including 34 inches height; above this the following amounts have been added for ordinary clothing (shoes, coats, and sweaters not included): 35–39 inches 1¼ pounds; 40–44 inches 1½ pounds; 45–49 inches 1¾ pounds.

* Prepared by R. M. Woodbury, and reprinted by permission of the Children's Bureau, United States Department of Labor.

TABLE 3

Height-Weight-Age Table for Girls from Birth to School Age *

Height (inches)	Average Weight for Height (pounds)	1 Mo.	3 Mos.	6 Mos.	9 Mos.	12 Mos.	18 Mos.	24 Mos.	30 Mos.	36 Mos.	48 Mos.	60 Mos.	72 Mos.
20	8	8											
21	9	9	10										
22	10½	10	11										
23	12	11	12	13									
24	13½	12	13	14	14								
25	15	13	14	15	15								
26	16½		15	16	17	17							
27	17½		16	17	18	18							
28	19			19	19	19	19						
29	20			19	20	20	20						
30	21½			21	21	21	21	21					
31	22½				22	22	23	23	23				
32	24					23	24	24	24	25			
33	25						25	25	25	26			
34	26½						26	26	26	27			
35	29						29	29	29	29	29		
36	30							30	30	30	30	31	
37	31½							31	31	31	31	32	
38	32½								33	33	33	33	
39	34								34	34	34	34	34
40	35½									35	35	35	36
41	37½										37	37	37
42	39										39	39	39
43	41										40	41	41
44	42½											42	42
45	45												45
46	47½												47
47	50												50
48	52½												52

Weight is stated to nearest pound, height to nearest inch, age to nearest birthday. Figures represent weight in pounds; weights are net up to and including 34 inches height; above this the following amounts have been added for ordinary clothing (shoes, coats, and sweaters not included): 35–39 inches 1 pound; 40–44 inches 1½ pounds; 45–49 inches 1¾ pounds.

* Prepared by R. M. Woodbury, and reprinted by permission of the Children's Bureau, United States Department of Labor.

TABLE 4

HEIGHT-WEIGHT-AGE TABLE FOR BOYS OF SCHOOL AGE *

Height (inches)	Average Weight for Height (pounds)	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years	11 Years	12 Years	13 Years	14 Years	15 Years	16 Years	17 Years	18 Years	19 Years	Height (inches)
38	34	34	*34*														38
39	35	35	35														39
																	39
40	36	36	*36*														40
41	38	38	38	*38*													41
42	39	39	39	*39*	*39*												42
43	41	41	41	*41*	*41*												43
44	44	44	44	44	*44*												44
45	46	46	46	46	*46*	*46*											45
46	48	*47*	48	48	48	*48*											46
47	50	*49*	50	50	50	*50*	*50*										47
48	53		52	53	53	53	*53*										48
49	55		55	55	55	55	55	*55*									49
50	58		*57*	58	58	58	58	*58*	*58*								50
51	61			61	61	61	61	61	*61*								51
52	64			63	64	64	64	64	64	*64*							52
53	68			*66*	67	67	67	67	68	*68*							53
54	71				70	70	70	70	71	71	*72*						54
55	74				*72*	72	73	73	74	74	*74*						55
56	78				*75*	76	77	77	77	78	78	*80*					56
57	82					*79*	80	81	81	82	83	*83*					57
58	85					*83*	84	84	85	85	86	87					58
59	89						87	88	89	89	90	90	90				59
60	94						*91*	92	92	93	94	95	96				60
61	99							95	96	97	99	100	103	*106*			61
62	104							*100*	101	102	103	104	107	111	*116*		62
63	111							*105*	106	107	108	110	113	118	123	*127*	63
64	117								109	111	113	115	117	121	126	*130*	64
65	123								*114*	117	118	120	122	127	131	134	65
66	129									119	122	125	128	132	136	139	66
67	133									*124*	128	130	134	136	139	142	67
68	139										134	134	137	141	143	147	68
69	144										137	139	143	146	149	152	69
70	147										143	144	145	148	151	155	70
71	152										*148*	150	151	152	154	159	71
72	157											153	155	156	158	163	72
73	163											*157*	160	162	164	167	73
74	169											*160*	164	168	170	171	74

Age—years		6	7	8	9	10	11	12	13	14	15	16	17	18	19
Average height (inches)	Short	43	45	47	49	51	53	54	56	58	60	62	64	65	65
	Medium	46	48	50	52	54	56	58	60	63	65	67	68	69	69
	Tall	49	51	53	55	57	59	61	64	67	70	72	72	73	73
Average annual gain (lb.)	Short	3	4	5	5	5	4	8	9	11	14	13	7	3	
	Medium	4	5	6	6	6	7	9	11	15	11	8	4	3	
	Tall	5	7	7	7	7	8	12	16	11	9	7	3	4	

Weight in ordinary clothing but without shoes, coats, sweaters. The figures represent weight in pounds; age at nearest birthday; height at nearest inch; weight at nearest pound. Italicized figures are estimated weights for children who are taller or shorter than usual for the age group. All unitalicized figures represent actual averages.

* Table prepared by Bird T. Baldwin, Iowa Child Welfare Research Station, State University of Iowa, and Thos. D. Wood, Columbia University. Reprinted by courtesy of the American Child Health Association.

TABLE 5

Height-Weight-Age Table for Girls of School Age *

Height (inches)	Average Weight for Height (pounds)	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years	11 Years	12 Years	13 Years	14 Years	15 Years	16 Years	17 Years	18 Years	Height (inches)
38	33	33	33													38
39	34	34	34													39
40	36	36	36	*36*												40
41	37	37	37	*37*												41
42	39	39	39	*39*												42
43	41	41	41	41	*41*											43
44	42	42	42	42	*42*											44
45	45	45	45	45	45	*45*										45
46	47	*47*	47	47	48	*48*										46
47	50	*49*	50	50	50	50	*50*									47
48	52		52	52	52	52	*53*	*53*								48
49	55		54	54	55	55	56	*56*								49
50	58		*56*	56	57	58	59	61	*62*							50
51	61			59	60	61	61	63	65							51
52	64			*63*	64	64	64	65	67							52
53	68			*66*	67	67	68	68	69	*71*						53
54	71				69	70	70	71	71	*73*						54
55	75				*72*	74	74	74	75	77	*78*					55
56	79					76	78	78	79	81	*83*					56
57	84					*80*	82	82	82	84	88	*92*				57
58	89						84	86	86	88	93	*96*	*101*			58
59	95						87	90	90	92	96	100	*103*	*104*		59
60	101						*91*	95	95	97	101	105	108	109	*111*	60
61	108							99	100	101	105	108	112	113	116	61
62	114							*104*	105	106	109	113	115	117	118	62
63	118								110	110	112	116	117	119	120	63
64	121								*114*	115	117	119	120	122	123	64
65	125								*118*	120	121	122	123	125	126	65
66	129									124	124	125	128	129	130	66
67	133									*128*	130	131	133	133	135	67
68	138									*131*	133	135	136	138	138	68
69	142										*135*	*137*	*138*	*140*	*142*	69
70	144										*136*	*138*	*140*	*142*	*144*	70
71	145										*138*	*140*	*142*	*144*	*145*	71

Age—years		6	7	8	9	10	11	12	13	14	15	16	17	18
Average height (inches)	Short	43	45	47	49	50	52	54	57	59	60	61	61	61
	Medium	45	47	50	52	54	56	58	60	62	63	64	64	64
	Tall	47	50	53	55	57	59	62	64	66	66	67	67	67
Average annual gain (lb.)	Short	4	4	4	5	6	6	10	13	10	7	2	1	
	Medium	5	5	6	7	8	10	13	10	6	4	3	1	
	Tall	6	8	8	9	11	13	9	8	4	4	1	1	

Weight in ordinary clothing but without shoes, coats, sweaters. The figures represent weight in pounds; age at nearest birthday; height at nearest inch; weight at nearest pound. Italicized figures are estimated weights for children who are taller or shorter than usual for the age group. All unitalicized figures represent actual averages.

* Table prepared by Bird T. Baldwin, Iowa Child Welfare Research Station, State University of Iowa, and Thos. D. Wood, Columbia University. Reprinted by courtesy of the American Child Health Association.

TABLE 6

Average Heights and Weights for Men *

Ft.	In.	15 Yr.	20 Yr.	25 Yr.	30 Yr.
		92	101	105	109
4	11	**102**	**112**	**117**	**121**
		114	126	131	136
		94	103	107	111
5	0	**104**	**114**	**119**	**123**
		117	128	134	138
		96	105	109	113
5	1	**107**	**117**	**121**	**125**
		120	131	136	140
		99	108	112	115
5	2	**110**	**120**	**124**	**128**
		124	135	139	144
		102	111	115	118
5	3	**113**	**123**	**128**	**131**
		127	138	144	147
		105	114	119	122
5	-	**117**	**127**	**132**	**135**
		131	143	148	152
		109	118	123	125
5	5	**121**	**131**	**136**	**139**
		136	147	153	156
		113	122	126	129
5	6	**125**	**135**	**140**	**143**
		140	152	157	161
		116	125	130	132
5	7	**129**	**139**	**144**	**147**
		145	156	162	165
		120	129	133	136
5	8	**133**	**143**	**148**	**151**
		149	161	166	170
		123	132	137	141
5	9	**137**	**147**	**152**	**156**
		154	165	171	175
		128	136	141	145
5	10	**142**	**151**	**157**	**161**
		159	170	176	181
		132	141	146	150
5	11	**147**	**156**	**162**	**167**
		165	175	182	188
		137	145	151	156
6	0	**152**	**161**	**168**	**173**
		171	181	189	194
		141	150	157	161
6	1	**157**	**166**	**174**	**179**
		176	186	195	201
		146	154	161	167
6	2	**162**	**171**	**179**	**185**
		182	192	201	208
		150	159	166	172
6	3	**167**	**176**	**184**	**191**
		188	198	207	215

Weights without clothing. Table ends at thirty; after that age, weight should remain fixed.
Three weights are given:
1. Middle figures (boldface) for medium build (medium bone weight for height). Average weight
2. Upper figures for slender build (light bone weight for height). 10% reduction from average weight
3. Lower figures for large frame (heavy bone weight for height). 12½% added to average weight

* Courtesy, Life Extension Examiners, New York.

TABLE 7

Average Heights and Weights for Women *

Ft.	In.	15 Yr.	20 Yr.	25 Yr.	30 Yr.
		90	95	97	100
4	8	**100**	**105**	**108**	**111**
		113	117	122	125
		91	96	99	102
4	9	**101**	**107**	**110**	**113**
		114	119	124	127
		92	98	101	104
4	10	**102**	**109**	**112**	**115**
		115	123	126	129
		94	100	103	105
4	11	**104**	**111**	**114**	**117**
		117	125	128	132
		96	103	104	107
5	0	**107**	**114**	**116**	**119**
		120	128	131	134
		99	105	107	110
5	1	**110**	**117**	**119**	**122**
		122	132	134	137
		102	108	111	113
5	2	**113**	**120**	**123**	**125**
		127	135	138	141
		104	111	113	116
5	3	**116**	**123**	**126**	**129**
		131	138	142	145
		108	113	116	119
5	4	**120**	**126**	**129**	**132**
		135	142	145	149
		112	117	120	123
5	5	**124**	**130**	**133**	**136**
		140	146	149	153
		115	121	123	126
5	6	**128**	**134**	**137**	**140**
		144	151	154	158
		119	124	127	130
5	7	**132**	**138**	**141**	**144**
		149	155	158	162
		122	127	131	133
5	8	**136**	**141**	**145**	**148**
		153	159	163	167
		126	131	134	136
5	9	**140**	**145**	**149**	**151**
		158	163	167	170
		131	134	137	140
5	10	**145**	**149**	**152**	**155**
		163	168	171	174
		135	139	140	143
5	11	**150**	**154**	**156**	**159**
		168	173	176	179

Weights without clothing. Table ends at thirty; after that age, weight should remain fixed.
Three weights are given:
1. Middle figures (boldface) for medium build (medium bone weight for height). Average weight.
2. Upper figures for slender build (light bone weight for height). 10% reduction from average weight.
3. Lower figures for large frame (heavy bone weight for height). 12½% added to average weight.

* Courtesy, Life Extension Examiners, New York.

Characteristics. A body capable of assuming and maintaining good posture is characteristic of good nutrition. Other characteristics include good skeletal development with straight bones and arms and unenlarged joints; broad, flat chest capable of fair expansion; normal pelvic arch; well-shaped and well-developed jaw and strong teeth, well-enameled and free from caries; well-developed muscles, padded with firm flesh and of good tonus; firm and abundant subcutaneous fat; smooth and lustrous hair.

Less obvious characteristics include proper functioning of the digestive, circulatory, respiratory, eliminative, and glandular systems and reasonable resistance to infections.

A good appetite and relish for food are considered, along with the above, as evidence of good nutritional condition as well as an ability to work with satisfaction, comfort, and emotional stability. Table 8 contrasts good and poor nutrition.

Essentials of Good Nutrition. *Nutrients.* The essentials for good nutrition include (1) adequate energy (carbohydrates and fats) for body needs and for maintenance of the correct weight for height and age; (2) protein, adequate in quality and quantity to build and repair muscle tissue, to regulate and to furnish some energy, and to provide certain amino acids necessary for the formation of important body compounds; (3) adequate minerals as building materials for bony structures and blood and as regulators of important body processes; (4) adequate vitamins as regulating substances for growth and health; (5) sufficient water and bulk for roughage for regulation; (6) palatability and digestibility of foods. These carbohydrates, fats, proteins, minerals, vitamins, and water are known as foodstuffs, food constituents, food principles, nutritional essentials, or simply nutrients. Table 9 indicates the allowances for these nutrients recommended by the Food and Nutrition Board of the National Research Council.

Foods. Such articles as milk, butter, eggs, cereals, fruits, and vegetables are referred to as foods and supply the specific nutrients in the diet. A food is defined as any substance which when taken into the body can be utilized to yield heat or energy, to build new tissue and repair worn-out tissue, to regulate body processes, and to aid in the production of important body compounds.

TABLE 8

CHARACTERISTICS OF GOOD AND POOR NUTRITION *

	Good Nutrition	*Poor Nutrition*
Body	Well developed	Undersized, poorly developed; physical defects, possibly
Weight	Approximately average for height and age	Underweight usually (10% or more) May be normal May be overweight (fat and flabby)
Muscles	Well developed and firm	Small and undeveloped; flabby
Skin and complexion	Turgid skin of healthy color	Skin loose; pale, waxy, or sallow color; blemishes
Subcutaneous fat	Good layer	Lacking usually
Posture and carriage	Good with head erect, chest up, shoulders flat, abdomen in; elastic step	Fatigue posture; shoulders rounded, wings, flat and narrow chest, protruding abdomen, head forward
Hair	Smooth and glossy	Rough and lusterless
Eyes	Clear and bright; no dark circles underneath	Dull; hollow or dark circles underneath
Facial expression	Bright and alert but without strain	Alert but strained; drawn and worried; dull and lifeless
Mucous membranes	Eyelids, mouth, and tongue clear and reddish pink	Pale
Spirits and disposition	Good natured and full of life	Irritable, apprehensive, and difficult to manage; nervous; overactive and fatigues easily or phlegmatic, listless; fails to concentrate
Activity	Active mentally and physically	Mental and physical vigor lacking
Sleep	Sound	Difficulty in getting to sleep; light sleeper; restless sleeper
Digestion and elimination	Good	Disturbed digestion; "nervous indigestion"; subject to constipation
Appetite	Good	Poor, fickle, or finicky
General health	Excellent; no physical defects; good endurance and vigor; good resistance to infections	Endurance and vigor lacking; diseased and enlarged tonsils or adenoids; defective teeth; susceptible to infections

* L. J. Bogert, *Nutrition and Physical Fitness*, 1943. Page 431, adapted. Courtesy of W. B. Saunders Company, Publishers.

TABLE 9

Recommended Dietary Allowances *

National Research Council Reprint and Circular Series 115. January 1943. Courtesy, the National Research Council.

	Calories	Protein, grams	Calcium, grams	Iron, mg.	Vitamin A, † I.U.	Thiamin (B_1), mg. ‡	Riboflavin, mg.	Niacin (Nicotinic Acid), mg.	Ascorbic Acid, mg.	Vitamin D, I.U.
Man (70 kg.)										
Sedentary	2,500	...	...	..	.....	1.5	2.2	15	..	....
Moderately active	3,000	70	0.8	12	5,000	1.8	2.7	18	75	§
Very active	4,500	..	...	..	.....	2.3	3.3	23	..	....
Woman (56 kg.)										
Sedentary	2,100	...	...	..	.....	1.2	1.8	12	..	....
Moderately active	2,500	60	0.8	12	5,000	1.5	2.2	15	70	§
Very active	3,000	...	...	..	.....	1.8	2.7	18	..	....
Pregnancy (latter half)	2,500	85	1.5	15	6,000	1.8	2.5	18	100	400 to 800
Lactation	3,000	100	2.0	15	8,000	2.3	3.0	23	150	400 to 800
Children up to 12 years:										
Under 1 year ‖	100/kg.	3 to 4/kg.	1.0	6	1,500	0.4	0.6	4	30	400 to 800
1–3 years ¶	1,200	40	1.0	7	2,000	0.6	0.9	6	35	§
4–6 years	1,600	50	1.0	8	2,500	0.8	1.2	8	50	....
7–9 years	2,000	60	1.0	10	3,500	1.0	1.5	10	60	....
10–12 years	2,500	70	1.2	12	4,500	1.2	1.8	12	75	....
Children over 12 years:										
Girls, 13–15 years	2,800	80	1.3	15	5,000	1.4	2.0	14	80	§
16–20 years	2,400	75	1.0	15	5,000	1.2	1.8	12	80	....
Boys, 13–15 years	3,200	85	1.4	15	5,000	1.6	2.4	16	90	§
16–20 years	3,800	100	1.4	15	6,000	2.0	3.0	20	100	....

* Tentative goal toward which to aim in planning practical dietaries; can be met by a good diet of natural foods. Such a diet will also provide other minerals and vitamins, the requirements for which are less well known.

† Requirements may be less if provided as vitamin A; greater if provided chiefly as the pro-vitamin carotene.

‡ 1 mg. thiamin equals 333 I.U.; 1 mg. ascorbic acid equals 20 I.U.

‖ Needs of infants increase from month to month. The amounts given are for approximately 6–8 months. The amounts of protein and calcium needed are less if derived from human milk.

¶ Allowances are based on needs for the middle year in each group (as 2, 5, 8, etc.) and for moderate activity.

§ Vitamin D is undoubtedly necessary for older children and adults. When not available from sunshine, it should be provided probably up to the minimum amounts recommended for infants.

Further Recommendations, Adopted 1942:

The requirement for *iodine* is small; probably about 0.002 to 0.004 milligram a day for each kilogram of body weight. This amounts to about 0.15 to 0.30 milligram daily for the adult. This need is easily met by the regular use of iodized salt; its use is especially important in adolescence and pregnancy.

The requirement for *copper* for adults is in the neighborhood of 1.0 to 2.0 milligrams a day. Infants and children require approximately 0.05 per kilogram of body weight. The requirement for copper is approximately one-tenth of that for iron.

The requirement for *vitamin K* is usually satisfied by any good diet. Special consideration needs to be given to newborn infants. Physicians commonly give vitamin K either to the mother before delivery or to the infant immediately after birth.

Figure 6 shows the United States government chart of foods needed daily for good nutrition or "The Basic Seven" suggested by the United States Department of Agriculture.

FIG. 6. Foods for good nutrition. Courtesy, War Food Administration, United States Department of Agriculture.

Relationship Between Chemical Composition of Food and the Body. As one of the chief functions of food is to build and repair body tissue, it is reasonable to assume that it must

in some way resemble this tissue. The resemblance lies not in appearance but in another characteristic, chemical composition. Both the body and food are chemically alike in that they are made up of the same elements and compounds.

Elements. The ultimate composition of a food is expressed in terms of elements. Nineteen recognized chemical elements are oxygen (O), hydrogen (H), carbon (C), nitrogen (N), calcium (Ca), phosphorus (P), iron (Fe), iodine (I), sulfur (S), chlorine (Cl), sodium (Na), potassium (K), magnesium (Mg), zinc (Zn), manganese (Mn), flourine (Fl), silicon (Si), cobalt (Co), and aluminum (Al).

Compounds. Four of the chemical elements, oxygen, hydrogen, carbon, and nitrogen, are supplied by water and the organic foodstuffs, carbohydrates, fats, and proteins. Water, the simplest of the foodstuffs, is composed of but two elements, oxygen and hydrogen. Carbohydrates, which include sugars and starches and also cellulose (indigestible but important in intestinal hygiene), are composed of three elements, carbon, hydrogen, and oxygen, the last two occurring in the proportion to form water. Fats contain the same elements as carbohydrates but in different proportions.

Proteins, being more complex in composition, contain, in addition to the three elements found in carbohydrates, nitrogen and sometimes sulfur. In proteins, these elements are combined in the form of amino acids.

Some of the remaining chemical elements, which are known as mineral elements, inorganic foodstuffs, or ash constituents, occur in organic combination with organic materials; others occur as inorganic salts, such as chlorides, sulfates, and phosphates. Calcium, potassium, magnesium, and sodium are base-forming; sulfur, phosphorus, and chlorine are acid-forming. The proximate composition of a food is expressed in terms of compounds.

Vitamins, of which four fat-soluble and ten or more water-soluble ones are now definitely recognized, are discussed more fully in a later chapter. They are organic in nature, but, because of the small amount of carbon present, they are not valuable for any energy properties.

Foods Classified. Foods may be classified according to the following.

1. Chemical composition
   - Organic: contain carbon and can be oxidized
   - Inorganic: do not contain carbon and cannot be oxidized
2. Function
   - Energy producers: carbohydrates, fats, proteins
   - Builders and repairers: protein, minerals
   - Regulators: minerals, vitamins, water
3. Basic and acid-forming properties
   - Base forming: milk, vegetables, fruits except prunes, plums, cranberries
   - Acid forming: meat, eggs, fish, cereals
4. Protective * qualities †
   - Highly protective: milk, cheese, eggs, liver, fat fish, green vegetables, salads, raw fruits, fruit juices, butter, cod-liver oil
   - Less protective: yeast, muscle meat, root vegetables, tubers
   - Non-protective (energy-giving primarily): legumes, refined cereals, nuts, sugars, vegetables
5. Predominating foodstuffs
   - Sources of the principal foodstuffs are shown in Table 10.

TABLE 10

SOURCES OF FOODSTUFFS

Sugar	*Starch*	*Fat*	*Protein*	*Calcium*	*Phosphorus*
Sugar in all forms	Flours	Cream	Milk in all forms	Milk in all forms except butter	Beans
Sirups	Cereals	Butter	Cheese	Green leafy vegetables	Cheese
Honey	Breads	Whole milk	Eggs	American cheese and cottage cheese	Eggs
Jellies	Rolls	Oils of all kinds	Meat, lean, all kinds	Molasses	Fish
Jams	Spaghetti	Coconut	Poultry, all kinds	Almonds	Liver
Marmalades	Macaroni	Lard	Fish, shellfish	Carrots	Meat
Dried fruits	Noodles	Crisco	Legumes, dried	Eggs	Milk
	Potatoes	Salad dressings of oil	Nuts	Dried figs	Rice
	Bananas	Bacon	Cereals, contain some protein	Maple sirup	Soybeans
		Olives		Soybeans	Broccoli
		Nuts			Corn
		Avocados			Lentils
		Margarines			Whole-grain cereals and products
		Suet			Peanuts
					Walnuts
					Legumes

* Protective foods supplement the diet in minerals and vitamins.

† League of Nations Final Report on Nutrition.

TABLE 10—*Continued*

SOURCES OF FOODSTUFFS

Iron	*Vitamin A*	*Vitamin B* (thiamin)	*Vitamin C* (ascorbic acid)	*Vitamin G* (riboflavin)	*Nicotinic Acid* (niacin)
Meat	Fish-liver oil	Whole grains	Liver	Milk	Lean meats
Egg yolk	Green leafy vegetables	Legumes	Brain	Eggs	Chicken
Green leaves	Yellow vegetables	Nuts	Kidney	Meat	Liver
Whole-grain cereals	Milk	Lean meats	Green leafy vegetables	Green leafy vegetables	Green leafy vegetables
Dried fruits	Red salmon	Wheat germ	Fresh fruits, especially citrus fruits	Whole cereals	Legumes
Legumes	Yellow fruits	Soybeans	Tomatoes, fresh, canned, dried	Legumes	Tomato juice
Oysters	Tomatoes	Egg yolk	Sprouted seeds	Glandular meats	
Molasses	Butter	Green peas	Fresh vegetables, especially cabbage and green pepper	Dark meats	
Soybeans	Egg yolk	Green Lima beans	Potatoes		
	Whole-milk cheese	Peanuts			
		Rice polishings			

How to Check on Essential Food Habits. The food selection score card, Table 11, may be used to determine whether you have developed the food habits considered basic for good nutrition.

TABLE 11

FOOD-SELECTION SCORE CARD

Food Group	*Foods*		*Perfect Score*	*Daily Credits*
I	Green and yellow vegetables		15	
	2 servings	15		
	1 serving	10		
	3–4 servings weekly	7		
II	Oranges, tomatoes, grapefruit, or raw cabbage or salad greens		15	
	2 servings	15		
	1 serving	10		
	3–4 servings weekly	7		
III	Potatoes and other vegetables and fruits		15	
	1 serving potatoes	5		
	2 servings others	10		
	1 serving	7		
	3–4 servings weekly	3		
IV	Milk		20	
	2 cups (adult)	20		
	3–4 cups (child)	20		
	1 cup	15		
	½ cup	10		
V	Meat, poultry, fish, or eggs, or dried beans, peas, nuts, or peanut butter		10	
	2 servings	10		
	1 serving	5		
	3–4 servings weekly	3		
VI	Bread, flour and cereals (Natural whole-grain, enriched or restored)		10	
	3 servings	10		
	2 servings	5		
	1 serving	3		
VII	Butter and fortified margarine		5	
	2 level T. (1 oz.)	5		
	1 level T. (1 oz.)	3		
	Water		10	
	6–8 cups	10		
	4 cups	5		
	2 cups	3		
	Total score		100	
	Deductions			
	Each meal omitted	10		
	Meals at irregular hours	10		
	Eating sweets between meals	5		
	More than 2 cups of tea or coffee daily	5		
	Final score			
	Average score for week			

Score of 95–100 indicates good food selection; 75–80 indicates fair food selection; 75 and below indicates poor food selection.

QUESTIONS AND ACTIVITIES

1. Record your present age, height in inches, what you consider your build to be, and your weight in pounds. Using any one of Tables 4 to 7, compare your weight with the average or standard for a person of your height, age, and sex.

Weigh yourself, with the same amount of clothing and at the same time of day, weekly for several weeks and chart your weight on graph paper. Are you the theoretically correct weight, overweight, or underweight? If overweight or underweight, seriously so? Why is underweight not too desirable in a high school student? Why is overweight not too desirable in adults?

2. How many class members are the correct weight? Overweight? Underweight? Are any members seriously overweight or underweight?

3. Rate yourself with the score card in Table 1. Discuss your rating.

4. Check on your present food habits as follows. Make a list of all the food and beverages you take at meal times and between meals for one week. Using the food-selection score card, Table 11, page 24, score your diet for each of the seven days and obtain your average score. Explain your score. If it is less than 85, study your week's dietary to see what is lacking among the essential foods or what habits need improving. Keep these points in mind as you progress with your nutrition study. Are you a breakfast-omitter? A between-meals eater? Why is either practice undesirable? What was your average daily intake of milk? Fruits? Vegetables? Whole grains?

5. Compare the weekly food scores of the class. What percentage of the class have what might be called good scores? What percentage have scores that could be improved?

6. What foods are most apt to be lacking in the high school boy's diet? The high school girl's diet? Why?

7. Which of the class members show evidences of good nutrition? Of poor nutrition?

8. Check the diet habits of an adult and a younger member of your family, using the plan suggested for your own diet check-up. Is each one of these dietaries adequate? If not, what suggestions can you make?

9. Using Table 10 for reference, classify the foods on your week's diet according to the different food groups. Which food groups occur the most often? How often does some protective food occur?

10. Why is good health of such importance to an individual? To the community? To the nation?

11. List all the health habits one should acquire for the best condition of health.

12. What are the results when one does not receive a sufficient quantity of food? Enough food but not the right kind? Why should such conditions be improved?

13. Distinguish between hidden hunger and hollow hunger, and give illustrations.

14. The workings of the human body have been likened to those of a machine. Elaborate on this comparison. Why do you think this comparison has been made? How is the body different from a machine?

15. Write a short article on the history of nutrition study.

16. Why were so many American families found, in recent dietary studies, to be ill fed? What can be done about this?

17. Secure from five of your classmates, other than those in your foods class, records of their last three meals for a twenty-four hour period. Were all the food groups represented on each set of three meals?

18. Start an animal feeding demonstration to show the importance of the right kind of food. Suggestions for feeding are given in the following reference: E. N. Todhunter and M. L. Andes. *Nutrition Experiments for Classroom Teaching,* State College of Washington, Pullman, Washington.

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UNIT ONE

ESSENTIALS FOR GOOD NUTRITION

CHAPTER II

ENERGY NEEDS OF THE BODY

Nature and Ways of Expressing Energy Value. Energy is defined as the power to do work. It is measured and expressed in terms of calories. There are two calories in use, the large (Calorie) and the small (calorie); the former, sometimes referred to as the kilocalorie, is the one used in nutrition. It is a unit or standard measure of fuel value and represents the amount of heat which will raise the temperature of 1 kilogram (2.2 pounds) of water 1° C. The energy output or expenditure of the body, the energy needs, and the energy value of foods are all expressed in terms of calories. Energy is also referred to as fuel, calories, or heat.

All changes occurring in energy substances in the body tissues and cells are referred to under the term energy metabolism. Basal energy metabolism refers to these changes occurring when the body is at physical rest.

Why the Body Needs Energy. Like an engine or machine, the body has certain work to do and, for this work, some form of energy is required. A machine needs energy only when it is actually working, but the body needs it at all times because it is a living organism and never really stops working until death occurs. Even though the body at times may appear to be at rest, certain internal activities, such as respiration, circulation, digestion, and glandular processes, are going on. There are also all kinds of external movements and activities of one kind or another in which the body engages. The internal activities are more or less uniform from day to day, but, the greater the external activity, the greater the need for energy and energy foods.

What Is Covered by Energy Needs. The body needs sufficient energy for the work it must do internally (involuntary activities) at all times whether asleep or awake, as well as any external activities (voluntary) in which it engages during waking hours.

Internal Activities (Basal Metabolism). A certain number of calories are required daily to cover the work of respiration, circulation, digestion, glandular functioning, maintenance of muscular tonus, and the like. The adult male requires, on the average, about 1,700 calories for this purpose; the adult female, about 1,400 calories. In other words, an adult in good health needs about 1 calorie for every kilogram of body weight for every hour of the day. Determination of the basal metabolism or basal metabolic rate (the number of calories given off 12–14 hours after the last meal by a person awake but lying still) can be made with a fair degree of accuracy by means of the apparatus discussed later and is frequently done in medical practice as an aid in diagnosis.

The basal metabolic rate fluctuates only slightly from day to day in the same individual. It varies from person to person because of body composition (the more muscle tissue, the higher the rate), age and growth (the rate being higher during periods of growth), intensity of muscle tonus (a higher rate accompanying muscle tension), and glandular activities (the rate being higher with an overactive thyroid gland).

External Activities. In addition to the basal needs just described, the body must have energy to cover all muscular movements and activities. These may vary greatly from day to day, depending on a variation in the severity of the activity. Walking around a room requires twice as many calories as sitting still; walking vigorously requires three times as many.

Effect of Food. The eating of food is followed by an increase in the number of calories given off. This stimulating effect which food has on metabolism is designated as the "specific dynamic action," which means that each type of the organic foodstuffs stimulates the metabolism to a different degree. The muscular work of digestion is thought by some to account for this stimulation. The true explanation is probably that the energy expended does not actually perform any body work but only heats the body and is then given off as waste heat. Proteins stimulate more than carbohydrates and fats; consequently, meats are sometimes known as heating foods, and large amounts are avoided in summer months or in warm climates. An additional number of calories, to the extent of 6 per cent of the total food

calories eaten, are needed to cover the calories expended as a result of the stimulation of food.

Growth. During certain periods of life, additional calories over and above those needed for maintenance and activity are required. Extra calories are demanded for growth in childhood and adolescence, for growth of the developing fetus in the later months of pregnancy, and for the extra demands caused by milk production in lactation.

Mental Work. It is ordinarily supposed that mental work increases the energy expenditure and therefore the calorie needs. The fallacy of this idea was demonstrated when Dr. Benedict observed that the heat output of a group of students taking an examination was not appreciably greater than that of a group of students sitting still for the same length of time. According to Dr. Benedict, half a peanut (with its 4 calories) will take care of the most intensive kind of mental work for 1 hour. Any small increases which actually occur during the period when mental work is being done are caused by increased muscle tension.

Diseased Conditions. During fevers, the basal metabolism is greatly increased, sometimes as much as 50 per cent, or about 7 per cent for every rise of 1 degree in temperature on the centigrade scale. Since the total food needs are correspondingly increased, the old advice to "starve a fever and feed a cold" is obviously inaccurate.

Energy Requirements of Adults and Children. Table 9 on page 19 shows the daily calorie requirements of individuals at various ages. Some tables indicate the calorie requirement in terms of calories per kilogram. Since 1 kilogram equals 2.2 pounds, weight can always be stated in kilograms by dividing the weight in pounds by 2.2. Girls between the ages of 10 and 13 years require 32–27 calories per pound; boys of the same age require 34–30 calories per pound. Girls between the ages of 14 and 17 years require 27–18 calories per pound; boys of the same age require 30–23 calories per pound. Young and middle-aged adults require 18–20 calories per pound if engaged in moderate exercise and 20–23 calories per pound if doing hard muscular labor.

Relation of Calories Eaten to Body Weight. If the food a person eats supplies just his actual energy needs, a constant

weight with only slight daily variations will be maintained. This number of calories may then be considered correct for that individual, if he remains in a good state of health. If his energy intake is greater than his needs, his weight will steadily increase; he will become overweight, as unused calories are stored as fat. If his energy intake is less than his needs, his weight will steadily decrease; he will become underweight. A child or an underweight adult cannot gain weight if his food calories just balance his calorie output.

For the person of correct weight, then, the food calories should equal those given off. Since the overweight person is eating more calories than he needs, to lose weight he must reduce his food calories so that some of the needed energy comes from his stored body fat.

During growth, and for the underweight adult, food calories eaten should be greater than output so that there will be extra food calories which can be stored as body fat. Theoretically, increasing or decreasing one's daily calorie intake by 500 calories over or under actual need should bring about an increase or decrease, respectively, in weight. In all the above calorie adjustments, attention must be paid to adequate amounts of protein, minerals, and vitamins.

How Energy Needs Are Determined. *In the Laboratory.* By means of a piece of apparatus known as a calorimeter and a method called calorimetry, the scientist can determine just how many calories are being given off by the body in the form of heat under different kinds of activity. This is done either directly or indirectly. Directly, the total amount of heat given off is measured by placing the individual in some type of a closed respiration chamber. These vary in size from a chamber large enough to allow only one person to recline to a chamber large enough to hold several persons.

Because of the well-known fact that a definite relationship exists between the amount of oxygen we breathe and the number of food calories burned, the heat output can be measured indirectly by determining the amount of oxygen consumed in a given length of time. This method is more frequently used in medical practice. Figure 7 illustrates how the oxygen consumption of a person is measured.

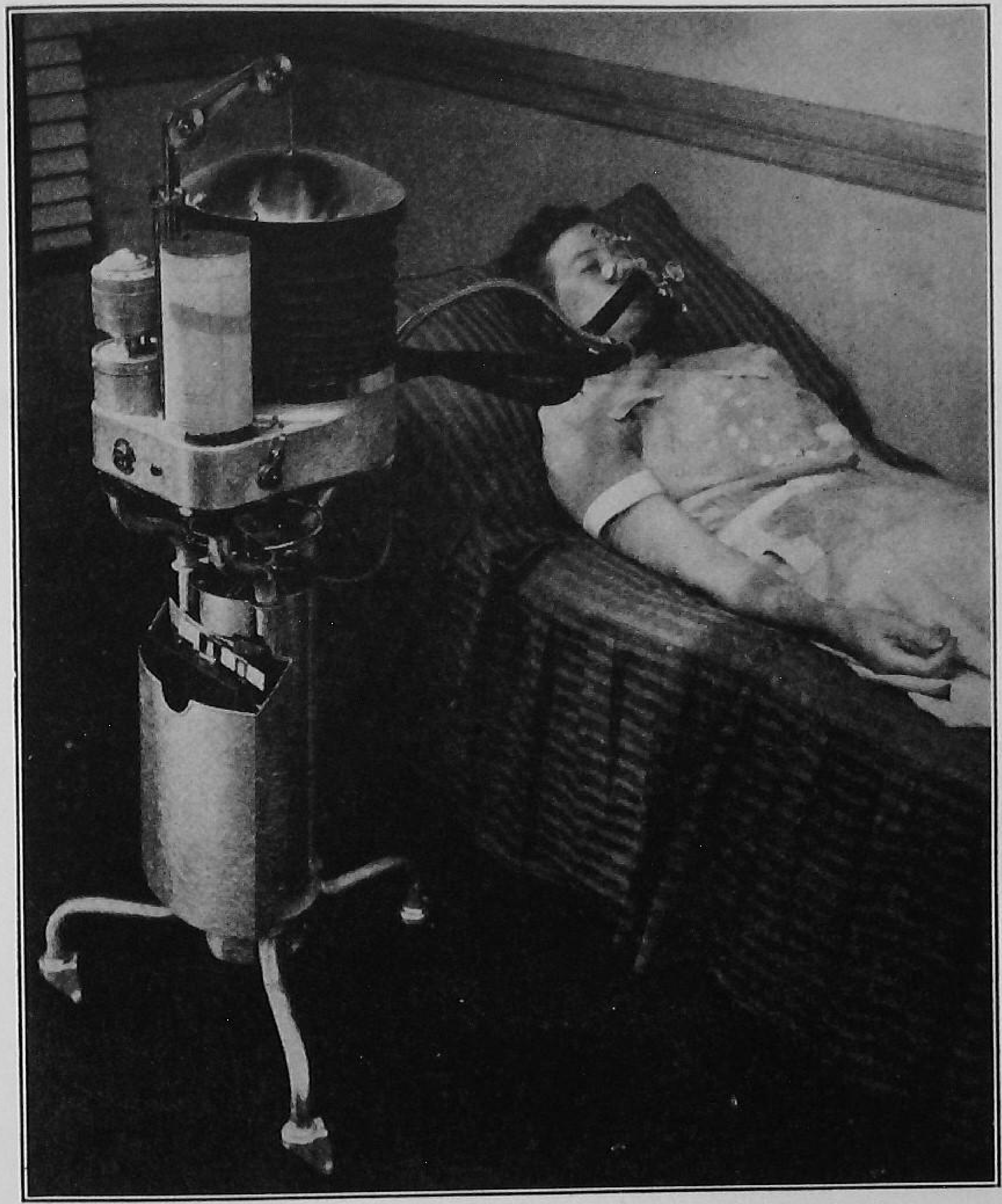

FIG. 7. Measuring the oxygen consumption of a person (indirect calorimetry). Courtesy, Sanborn Company, Cambridge, Massachusetts.

Estimation. Less accurately, a person may determine his total energy needs (1) by multiplying the average or standard weight for his height and age by the appropriate figure representing his requirement for calories per pound as given on page 29 (for example, a girl weighing 90 pounds will require 90 × 23 [average between 27 and 18] or 2,070 calories); or (2) recording all his activities for a 24-hour average day, estimating the number of hours spent sleeping, sitting, standing, in light exercise, etc.,

TABLE 12

Energy Expenditure per Hour under Different Conditions of Muscular Activity *

Activity	*Cal. per kg. or per 2.2 lb. exclusive of basal metabolism and influence of food*
Bicycling (century run)	7.6
Bicycling (moderate speed)	2.5
Cello playing	1.3
Crocheting	0.4
Dancing, foxtrot	3.8
Dancing, waltz	3.0
Dishwashing	1.0
Dressing and undressing	0.7
Driving automobile	0.9
Eating	0.4
Exercise	
Very light	0.9
Light	1.4
Moderate	3.1
Severe	5.4
Very severe	7.6
Horseback riding, walk	1.4
Horseback riding, trot	4.3
Horseback riding, gallop	6.7
Ironing (5-lb. iron)	1.0
Knitting sweater	0.7
Laundry, light	1.3
Lying still, awake	0.1
Organ playing (⅓ hand work)	1.5
Painting furniture	1.5
Paring potatoes	0.6
Playing ping-pong	4.4
Piano playing (Mendelssohn's songs)	0.8
Piano playing (Beethoven's "Sonata Appassionata")	1.4
Piano playing (Liszt's "Tarantella")	2.0
Reading aloud	0.4
Running	7.0
Sewing, hand	0.4
Sewing, foot-driven machine	0.6
Sewing, motor-driven machine	0.4
Singing in loud voice	0.8
Sitting quietly	0.4
Skating	3.5
Standing at attention	0.6
Standing relaxed	0.5
Sweeping with broom, bare floor	1.4
Sweeping with carpet sweeper	1.6
Sweeping with vacuum sweeper	2.7
Swimming (2 mi. per hr.)	7.9
Typewriting rapidly	1.0
Violin playing	0.6
Walking (3 mi. per hr.)	2.0
Walking rapidly (4 mi. per hr.)	3.4
Walking at high speed (5.3 mi. per hr.)	8.3
Walking downstairs	†
Walking upstairs	‡
Washing floors	1.2
Writing	0.4

* M. S. Rose, *Foundations of Nutrition.* Page 58. Fourth Edition, 1944. Courtesy of The Macmillan Company, Publishers.

† Allow 0.012 cal. per kg. for an ordinary staircase with 15 steps, without regard to time.

‡ Allow 0.036 cal. per kg. for an ordinary staircase with 15 steps, without regard to time

and determining the number of calories given off during each period of activity.* The total represents the number of calories given off and the number that should be eaten.

Example. A woman weighing 130 pounds, or 59 kilograms, spends the following hours on these specified activities.

2 hours of dishwashing *	2 × 1 × 59 =	118.0
2 hours of light laundry *	2 × 1.3 × 59 =	153.4
2 hours of hand sewing *	2 × 0.4 × 59 =	47.2
2 hours driving an automobile *	2 × 0.9 × 59 =	106.2
2 hours ironing *	2 × 1.0 × 59 =	118.0
1 hour sweeping with carpet sweeper *	1 × 1.6 × 59 =	94.4
5 hours sitting at rest *	5 × 0.4 × 59 =	118.0
Number of calories required for the day's activities =		755.2

Number of calories required for basal metabolism = 1,369.0

59 (kg.) × 1 (cal. per kg.) × 24 (hours) = 1,416
Saving in sleep = 59 × .1 × 8 (hours) = 47
1,369

Basal metabolism plus internal activities	= 2,124.2
Effect of food equals 6 per cent extra	= 127.4
Total energy needs for the day	= 2,251.6 calories

Foods as Sources of Energy. For a very short time, the body might burn its own tissues for energy but this would be undesirable from the standpoint of health, if continued for very long. Foods must serve this purpose, and the carbohydrates, fats, and proteins in various food articles provide the sources of energy to the body. The three foodstuffs can be used by the body in the same way that gasoline is used by the engine, and, in the liberation of the energy from these foods, oxidation takes place.

The number of calories furnished by foods depends upon their composition and the way the body uses them. Generally, foods which have a high fat content and a low water content yield a large number of calories, and foods high in water and residue are low in calories. Foods yielding the highest number of calories include butter, cream, lard, and fat meat; foods with little moisture, such as dried peas, beans, and lentils, dried fruits and vegetables and milk, meat, and cereals, contain a moderate

* See Table 12.

number. While some servings of foods as eaten do contain more calories than others, no foods of any kind can be said to be fattening in the sense that they, in themselves, actually add weight. Overweight is caused by too many calories, from any source, which have to be stored some place and are converted into body fat for this purpose.

Hundred-calorie portions of some familiar foods are shown in Figure 8, and the calorie content of 100-gram portions of foods are listed in Table 13 on page 36.

How Energy Values of Foods Are Determined. *In the Laboratory.* By means of either a bomb or oxy-calorimeter, the scientist determines how much energy carbohydrates, fats, and proteins give off when burned. The resulting figures are 4.1, 9.45, and 5.65 calories respectively for carbohydrates, fats, and proteins. These figures are slightly lower when the same foodstuffs are used by the body, because of the fact that digestion is not apt to be complete and some of the material is not combustible by the body as it is in the calorimeter. Therefore, the calorie value figures commonly used for carbohydrates, fats, and proteins are 4, 9, and 4 calories per gram of carbohydrates, fats, and proteins respectively.

From Food Composition. Scientific laboratories have furnished us with accurate figures for food composition, and the proportions of carbohydrates, fats, and proteins are readily available in food tables in government and other publications.* The energy value of any food in any amount may be determined once the food composition is known.

Example. One ounce of milk contains 1 gram of protein, 1.2 grams of fat, and 1.5 grams of carbohydrate. The calorie value of 1 pint (16 ounces) is determined by multiplying the protein

* *United States Department of Agriculture:*

Bulletin 28, "The Chemical Composition of American Food Material." W. O. Atwater and A. P. Bryant.

Circular 50, "Proximate Composition of Fresh Fruits." C. Chatfield and L. I. McLaughlin.

Circular 146, "Proximate Composition of Vegetables." C. Chatfield and G. Adams.

Circular 549, "Proximate Composition of American Food Materials." C. Chatfield and G. Adams.

A. de P. Bowes and C. F. Church, *Food Values of Portions Commonly Used,* 1944. Published by the authors, Philadelphia, Pennsylvania.

FIG. 8. One-hundred-calorie portions of a few familiar foods. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

TABLE 13

CALORIE VALUES OF 100-GRAM PORTIONS OF FOODS *

(100 grams = 3⅓ ounces)

Less than 50 cal.	50–100 cal.	100–200 cal.	200–300 cal.	300–400 cal.	400–500 cal.	500–600 cal.	Over 600 cal.
Asparagus	Apples	Baked beans	Dried apricots	Green Limas	Graham crackers	Broiled bacon	Almonds
Snap beans	French artichokes	Lean beef, round	Avocado	American cheese	Soda crackers	Peanuts	Butter
Beets	Bananas	Bluefish	Graham bread	Cornflakes		Potato chips	Cashew nuts
Beet greens	Blackberries	Cottage cheese	White bread	Dates			Hazelnuts
Broccoli	Blueberries	Chestnuts	Light cream	Egg yolk			Peanut butter
Buttermilk	Brussels sprouts	Chicken	Ice cream	Farina			Pecans
Cabbage	Sweet cherries	Corn, fresh	Lamb, leg	Dried figs			Mayonnaise
Cantaloupe	Clams	Whole egg	Dried prunes	Honey			Walnuts
Carrots	Cod	Liver	Tongue	Lentils			
Cauliflower	Canned corn	Fresh peas		Oatmeal			
Celery	Dandelion greens	Canned salmon		Ham			
Chard	Grapes	Sweet potatoes		White rice			
Collards	Milk	Canned tuna		Soybeans			
Watermelon	Oranges	Veal		Granulated sugar			
Water cress	Oysters			Shredded wheat			
Cucumber	Parsnips						
Eggplant	Peaches						
Egg white	Pears						
Escarole	Canned peas						
Grapefruit	Pineapple						
Grape juice	Pineapple juice						
Kale	Plums						
Kohlrabi	Potatoes						
Lettuce	Raspberries						
Muskmelon	Shrimp						
Onions							
Rhubarb							
Spinach							
Squash							
Strawberries							
Tomatoes							
Tomato juice							
Turnips							
Turnip tops							

* H. C. Sherman, *Chemistry of Food and Nutrition*, compiled from Table 62, page 555. Sixth Edition, 1941. Courtesy of The Macmillan Company, Publishers.

and carbohydrate grams by 4 and then by 16 and the fat grams by 9 and then by 16. The total figure is 332.8 calories in 1 pint of milk.

How to Meet Energy Requirements. An adult requires 4 to 6 grams of carbohydrate per pound of body weight (about 50 to 60 per cent of his total calories), 1 to 2 grams of fat (about 30 to 40 per cent of his total calories), and ⅔ to 1½ grams of protein (about 10 to 15 per cent of his total calories). For a child, the requirements per pound of body weight are 6 to 10 grams of carbohydrates (about 50 per cent of total calories), 2 to 3 grams of fat (about 35 per cent of total carbohydrates), and 2 to 3 grams of protein (about 15 per cent of total calories).

For optimum nutrition, authorities suggest that at least 50 per cent of the total calories should be supplied by the protective foods: milk, fruits, vegetables, eggs, and whole grains. Actually more than 50 per cent of the total calories needed by the average adult are supplied by the suggested amounts of protective foods on the chart shown in Figure 6. Table 14 indicates the suggested desirable distribution of the total daily calories between the various food groups for a healthy adult requiring 2,500 calories, a high school girl or boy requiring 2,000 calories, and a preschool child requiring 1,500 calories.

TABLE 14

Distribution of Calories *

Class of Food	*Per Cent of Total Calories* Adult (2,500 cal.)	High School Boy or Girl (2,000 cal.)	Preschool Child (1,500 cal.)
I. Food from cereal grains (including bread)	20–28	16–23	15–23
II. Milk	14	34	45
III. Vegetables and fruits	16–24	16–23	15–23
IV. Fats and oils	15–20	12–13	5–8
V. Sugars	8–10	5–8	1–4
VI. Meats, eggs, cheese, etc.	10–16	6–9	5–8 (some meat or fish or mild cheese)

* M. S. Rose, *Foundations of Nutrition*, 1944. Adapted from Table XVII, pages 578–579. Courtesy of The Macmillan Company, Publishers.

QUESTIONS AND ACTIVITIES

1. Compare the calorie values of food by one of these three methods.

a. Weigh 100-calorie portions * of representative foods, calculate the cost, set up as an exhibit, and discuss.

b. Weigh out 100-gram portions of foods, calculate the calorie values and cost of each, set up as an exhibit, and discuss.

For which of the foods under *a* do 100-calorie portions represent average servings as eaten?

For what foods under *b* are 100-gram portions approximately the size of average servings as eaten?

c. Arrange average servings of foods in the following calorie groups: foods, the average servings of which supply less than 50 calories, 50–100 calories, 100–200 calories, 200 or more calories.

2. Using the data in this and previous chapters, estimate the average weight and determine how many calories each of the following persons would need.

Person	*Weight*	*Occupation*	*Calorie Requirement*
Woman		Homemaker	
Boy, 17 yr.		High school student	
Girl, 16 yr.		High school student	
Child, 10 yr.			
Man		(Moderate activity)	

3. Calculate the approximate number of calories you need every day, from the data on page 29. Use your normal weight for this purpose.

4. Calculate more accurately the calories you need by keeping a record of your activities for one twenty-four-hour period and follow directions under the example on page 33.

5. Compute the calories in each of three day's menus, of which a record was kept in Activity 4, Chapter I. Obtain the average figure. How does the average figure for these three days compare with the figure which you obtained for your actual requirement in Activity 4 above? To determine calories use the Food Table in the Appendix. What part of the day's total calories comes from breakfast? From lunch? From dinner? What is a reasonable distribution of calories for the day between the three meals? How does yours compare?

6. What percentage of the total calories you consumed came from milk? From vegetables and fruits? From eggs? From whole-grain or

* Consult M. S. Rose, *A Laboratory Handbook for Dietetics*, The Macmillan Company, 1937.

enriched cereal products? What proportion of the total calories from all these groups of foods (protective foods)?

7. Why is breakfast an important meal of the day? What are the expected results if one goes continuously without breakfast?

8. Secure a copy of a day's menus from the school cafeteria. Select a meal for a person who wishes to lose weight, for a person who wishes to gain weight.

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CHAPTER III

REQUIREMENTS FOR BUILDING AND REPAIR—PROTEINS

Building and Repair Needs of the Body. The body needs specific materials for building and repairing various tissues and organs as well as materials for energy to do its work. Bony structures, blood, muscles, and nerves need to be built up and then repaired as they are worn down in the course of life. During the growing period, substances are necessary for the construction of the body primarily and, in addition, for the maintenance of the parts already formed.

In early life, where rapid growth is taking place, protein is required for building new muscle tissues as they are being formed. After adulthood has been reached, there is no longer a need for protein for building material but it is still necessary to replace that which has been destroyed in the ordinary wear and tear in the cells.

Both proteins and minerals constitute important building materials, the former for muscles and the latter for the bony structures and blood. Proteins will be considered in this chapter, and the building functions of minerals, along with their regulating functions, will be considered in the following one.

Protein in the Body. Protein is an important constituent of every cell in the body, being an essential part of the nucleus and protoplasm, but it is found for the most part in active muscle tissue. Except for water, protein makes up the greatest part of the body tissues, about 18 per cent.

Nature of Protein. Proteins form one of the groups of substances or foodstuffs mentioned in Chapter II as sources of energy. The fact that proteins, unlike carbohydrates and fats, contain nitrogen, gives them the unique and very important function of growth for the formation of muscle tissue. Sixteen

per cent of protein is nitrogen, so, for every 100 grams of protein, there are 16 grams of nitrogen represented.

The four chemical elements, carbon, hydrogen, oxygen, and nitrogen, contained in protein are combined into substances called amino acids (amino because they contain a chemical group known as the amino or nitrogen-containing group). Twenty-two amino acids are now recognized, ten of which are of such importance in nutrition that they are considered indispensable or "nutritionally essential," meaning that they must be fed in the form of food protein. The ten are: arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophane, and valine.

Various combinations of the above amino acids form the proteins in foods as we recognize them. Examples are the lactalbumin and casein in milk, and ovalbumin and ovovitellin in eggs.

Why the Body Needs Protein. *Building.* Growth cannot take place without the nitrogen supplied in the diet in the form of protein. Physical development during childhood and adolescence is characterized by the formation of new structures, organs, and muscle tissues. Either insufficient amounts or wrong kinds of proteins in the diet result in poor growth.

During pregnancy, protein is needed for the growth requirements of the developing child; during lactation it is needed for the production of milk adequate in protein for the nursing child. After a wasting disease at any age, generous amounts of protein are needed in the construction of new tissues to replace those destroyed during the illness.

Maintenance. In childhood the new tissue produced needs to be maintained as it is subjected to the ordinary wear and tear of daily life. In the average adult, protein is needed primarily for the maintenance and repair of worn-out tissues since growth has ceased. The instances where it is needed by the adult for any growth purposes are mentioned above.

Energy. Protein, like carbohydrates and fats, can be burned for heat and energy. Actually, the body need not depend on protein for this purpose if there are sufficient carbohydrates and fats in the diet. In any case, it would be uneconomical to use protein primarily for energy, as protein foods are more expensive than the other more available energy foods.

Regulation. Because of the chemical nature of the proteins, they can also be classed among the regulating foods. They provide one of the effective ways the body has of maintaining what is called its acid-base balance.

Precursors of Important Body Substances. Certain of the amino acids are important for the formation of several body compounds having significant functions. One or more amino acids are essential to the construction of such substances as insulin (secretion of the pancreas), thyroxine (secretion of the thyroid gland), adrenaline (secretion of the adrenal gland), and hemoglobin (iron-carrying protein of the blood).

Requirement for Protein and Ways of Stating. *Method of Determining.* No such apparatus as the calorimeter is available for determining how much protein is required daily. A laboratory technique, called a nitrogen-balance experiment, is used for this purpose. The amount of protein eaten (in terms of nitrogen) and the amount of protein leaving the body (in terms of nitrogen in the urine and feces) are analyzed chemically and a comparison made between the intake and the output. The number of grams of protein eaten which will allow approximately the same amount of nitrogen to be excreted or will maintain a balance between intake and output is considered the minimum amount of protein required daily by an adult.

Factors Affecting Requirement. Growth, the kind of protein eaten, and the completeness with which digestion and absorption of protein is accomplished determine how much protein is needed every day. During the growing period, the requirement is higher in comparison to adult need. A child, therefore, needs more protein per pound of body weight than does the adult, and also more of his total calories should be supplied by protein.

Animal sources of protein are considered better nutritionally than plant sources, so smaller amounts of the former possess the same nutritive value as larger amounts of the latter. The reason for this is explained later in the chapter.

Muscular Work. It is commonly believed that muscular work greatly increases the need for protein and that large quantities of meat are necessary where active muscular work is to be done. If the diet contains sufficient amounts of carbohydrates and fats, no more protein than the amount usually considered adequate

for the adult need be fed. The athlete does not need meat at every meal.

Ways of Stating Protein Requirement. The protein requirement may be estimated and stated in terms of total calories. For the adult, 10 to 15 per cent of the total calories needed for the day should be supplied by protein foods; the ration of the growing child should have 15 per cent derived from the same foods. Another method is to allow 2 to 3 protein calories per pound, or 1 gram of protein per kilogram of body weight, for an adult and 4 to 6 protein calories per pound, or 1½ to 2 grams of protein per kilogram of body weight, for the growing individual.

Stated in total amount of protein per day, the minimum adult requirement is 45 grams. Since there is a wide range, however, between this minimum and the amount considered best for health, about 1½ to 2 times the minimum figure of 45 grams is the better one. The National Research Council recommends 60 grams per day for the adult woman and 70 grams per day for the adult man and 40 to 100 grams for children from one to twenty years of age. Recommended allowances for protein are given in Table 9 on page 19.

Protein in Food. Protein is found in a number of foods in varying amounts and forms and is composed of amino acids, as stated earlier. The nutritive value of a single protein depends upon its assortment of amino acids. If it contains all the so-called indispensable or nutritionally essential amino acids, it is known as a complete protein. This means that it will promote growth and also maintain body tissues. Generally, proteins from animal sources (with the exception of gelatin) are adequate. Examples of complete proteins are casein and lactalbumin in cheese and milk; ovalbumin and ovovitellin in eggs; albumin and myosin in lean meats; glycinin in soybeans; glutenin in wheat; and glutelin in corn.

If a protein lacks one or more of the indispensable amino acids, it is known as incomplete or inadequate since it cannot support growth even though it can maintain weight. A complete protein may appear to be incomplete if it is fed in amounts smaller than those required. Some proteins are so lacking in essential amino acids that they can neither support growth nor maintain body tissues.

Examples of incomplete proteins are zein in corn, gelatin,

phaseolin in navy beans, legumin in peas, legumelin in soybeans, and the partially incomplete gliadin in wheat.

Foods that are especially rich in protein are milk, cheese, eggs, meats, legumes, nuts, and gelatin. The storage parts of plants,

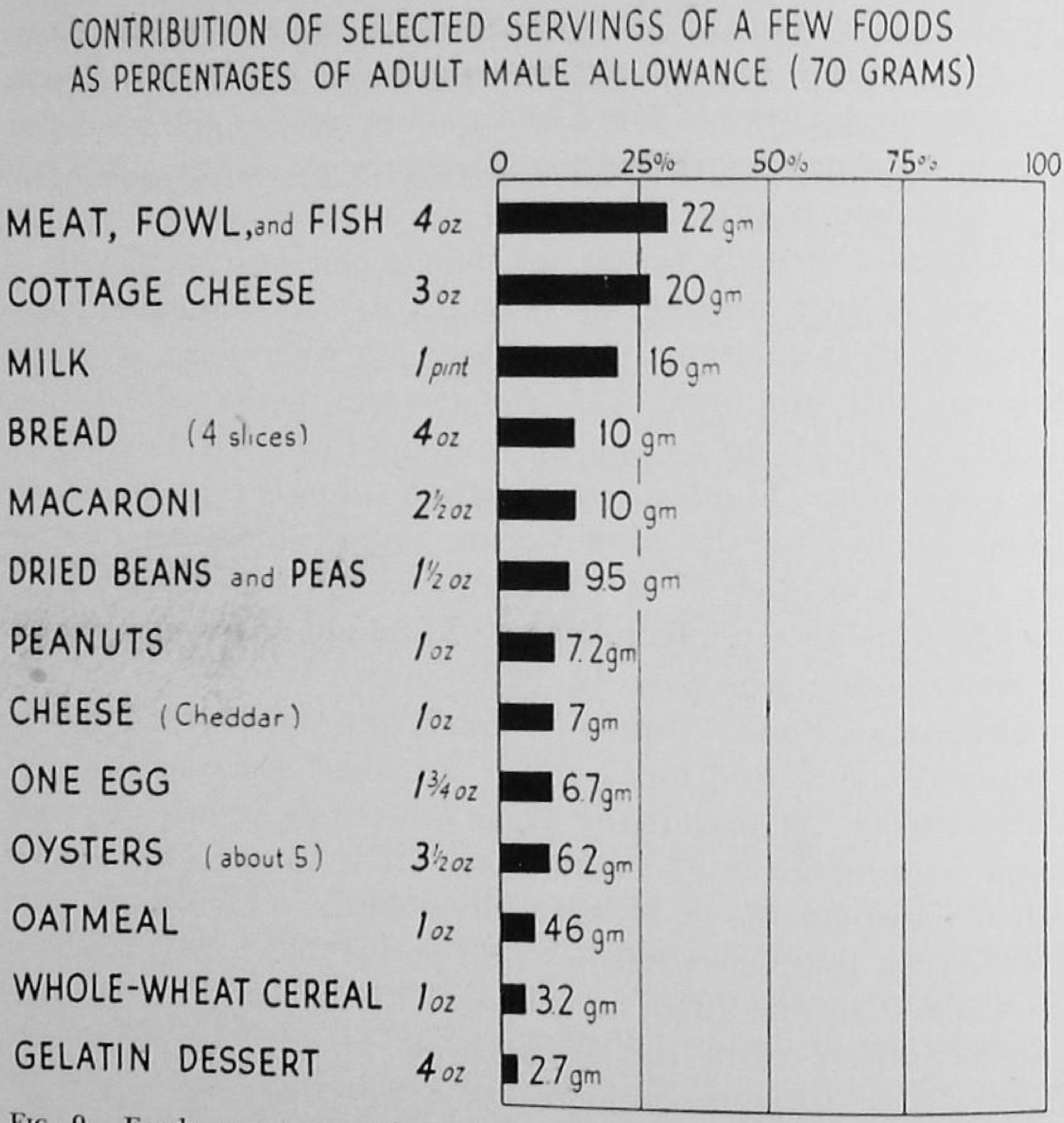

FIG. 9. Foods as sources of protein. Animal foods are the best source of good quality protein. Food Charts, 1942. Courtesy, American Medical Association.

particularly the seeds, are also a source of protein. Milk, cheese, eggs, meats, and most nuts contain the complete proteins; the forms existing in grains, legumes, other vegetables, and gelatin are partially or totally incomplete. These latter forms need to be supplemented in the diet by some of the foods from animal origin. Figure 9 compares foods as sources of proteins.

How to Meet the Protein Need. It would be too difficult and time consuming for the average person to have to stop and

calculate daily the amount in grams of protein he requires. For this reason, the protein requirement can be stated in terms of foods, the minimum being assured in the daily diet of an adult who takes 1 pint of milk (skimmed or whole), 1 serving of cheese or egg, 1 serving of meat, 3 or 4 servings of cereal products (including breadstuffs), and 1 serving of legumes. The approximate amount of protein grams in some of the common foods is shown in Figure 9.

The following list of foods provides for adequate protein in the diet of an adult:

1 pint of milk	16.0 protein grams
1 egg	6.7
1 cube of American cheese	7.0
1 serving of lean beef	22.0
1 serving of oatmeal	5.0
1 serving of dried peas	10.0
4 slices of bread	10.0
Total	76.7

Animal protein provides 52 grams (50 per cent of the protein should come from animal sources). Plant protein provides 25 grams.

QUESTIONS AND ACTIVITIES

1. Of what importance is protein in the diet?
2. List the proteins from animal sources, from plant sources. Why are the former called complete? The latter, partially complete?
3. Why should the diet contain protein from both animal and plant sources with the greater part coming from the former?
4. In which case is the quality of the protein more important, in the diet of the child or in the diet of the adult? Why is a deficiency of protein in the diet more serious for the child than for the adult?
5. How does exercise affect the daily requirement for protein?
6. If the main dish for a meal were chosen from the legumes or cereal products, such as split pea soup, bean loaf, or fried cornmeal mush, what other dishes should be in the meal in order to be sure that the proteins have the right assortment of amino acids?
7. Using the figure, 1½ to 2 grams of protein per kilogram of body weight, calculate how much protein you require daily. Make a list of foods you would have to eat daily to furnish this amount of protein.
8. Look up your calorie requirement as you calculated it in Activity 3 or 4, Chapter II. Determine how much 10 to 15 per cent of this

figure will be. This gives you the number of protein calories you need. Divide this figure by 4 to obtain the number of protein grams you require. How does this figure compare with the figure you obtained in Activity 7 above?

9. Classify the protein foods on the first three days of your dietary record under complete and incomplete. Do the complete ones predominate? If not, what changes in your diet might be desirable?

10. Estimate the amount of protein on each of the first three days of your diet record (Activity 4, Chapter I) and obtain the average. Is this average figure sufficient to cover your protein needs as calculated in Activities 7 and 8 above?

11. What percentage of the average total calories you consumed came from protein? Does this figure constitute, as it should, 10 to 15 per cent of the total calories?

12. Keep a list of the protein foods eaten by your family for one week. Are all kinds of proteins represented? Do proteins from animal sources predominate?

13. How can you secure adequate protein when meat is scarce?

14. Outline three different plans for including sufficient protein in the diet. In the first plan, include meat and egg; in the second, egg but no meat; in the third, neither meat nor egg.

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CHAPTER IV

REQUIREMENTS FOR REGULATION AND PROTECTION—MINERALS AND WATER

MINERALS

Substances Which Regulate Body Processes. The indigestible carbohydrates, cellulose, and hemicellulose in foods commonly referred to as roughage or bulk or residue regulate the elimination of waste material from the intestinal tract. Water is considered a regulator because of its ability to act as a solvent for certain substances and because of the aid it gives to such body processes as circulation and excretion. Roughage and water will be discussed in greater detail in a later chapter.

Minerals and vitamins also constitute extremely important regulators because they help in the normal body processes and functioning of body organs.

Minerals in the Body and in Foods. Although we think of the body as being made up of organs, tissues, and cells, these in turn are made up of different chemical elements. Some nineteen or more chemical elements are present in the body. Five of them (carbon, hydrogen, oxygen, nitrogen, and sulfur) are combined with carbohydrates, fats, and proteins. The remaining fourteen (calcium, phosphorus, iron, iodine, magnesium, manganese, sodium, chlorine, potassium, copper, fluorine, silicon, aluminum, and zinc), referred to as mineral elements, constitute only a very small portion of the body weight but have an importance in the body out of all proportion to the amount present. They are essential to the structure and function of the body at every age and stage of development.

Seven minerals (calcium, magnesium, sodium, potassium, phosphorus, sulfur, and chlorine) comprise about 60 to 80 per cent of all the minerals in the body and are sometimes referred to as the principal mineral elements. The remaining elements (iron,

copper, iodine, manganese, cobalt, zinc, fluorine, silicon, boron, and aluminum) are called the trace elements. Trace elements are considered by some to be those occurring in the tissues or nutritionally essential in amounts equal to or less than iron; by others, they are considered to be all elements below iron. The mineral elements are combined in compounds called salts, mainly chlorides, phosphates, sulfates, and bicarbonates.

Some inorganic mineral salts may exist as such in foods, while others are found in organic combination in foods, the inorganic form resulting when foods are burned. This ash left behind when food is burned is referred to as ash constituents, inorganic or non-combustible constituents, mineral matter, etc.

Each mineral plays a very important physiologic role independently, but, because of various interrelationships between many of the minerals, their joint functions may be much more significant. A proper balance between minerals and mixture of all minerals is most important. Because minerals play a part in constructive processes as well as regulatory processes in the body, they are said to play a double role in nutrition.

Building Functions of Minerals. As stated in Chapter III, protein builds and repairs muscle tissue. Minerals are needed by everyone as materials for building bones and teeth (calcium and phosphorus), blood (all salts, especially iron and copper), nervous tissue (all salts, especially phosphorous), soft tissues (all salts), hair, skin, and nails (sulfur), certain glandular secretions (chlorine of gastric juice), and others. An adult requires sufficient minerals to cover the losses resulting from daily wear and tear since he may excrete as much as 20 to 30 grams of mineral salts daily. A larger amount of these substances is needed during the growing period as provision must be made for wear and tear as well as for a reserve for building new body tissues.

Regulating Functions of Minerals. As regulators, minerals have an equally important, if not more important, part to play in practically all functions of cells and organs. The proper functioning of both muscles and nerves depends upon the presence, in the fluid which bathes them, of certain minerals in the right amount and proportion. Otherwise muscles will not contract nor will nerves respond to nervous stimuli. In this connection, the various minerals have opposite effects individually, but a balance is maintained in the body between the stimulating

effects of calcium and the depressing effects of magnesium, sodium, and potassium.

The movement of liquids in the body is also dependent upon minerals, as they assist in the absorption of the liquefied digested food material and water from the intestine, the passage of water from the blood to the tissues, and the withdrawal of waste products from the blood and their elimination from the body.

The carrying of oxygen from the lungs to the tissues and the removal of carbon dioxide from the tissues would be impossible without minerals. Iron functions particularly in this connection. Coagulation of the blood, necessary following wounds because it prevents bleeding to death, is brought about by minerals (for example, calcium). A very important regulating function of minerals is keeping the blood and tissues neutral, that is, neither too acid nor too basic.

Minerals as Acid and Base Elements. Mineral elements that are left in the tissues after foods are digested, absorbed, and burned may possess either acid-forming or base-forming possibilities. If the foods eaten contain an excess of calcium, sodium, magnesium, and iron, they are said to be base-forming and show, in their residue, base-forming properties. The presence in other foods of a predominating amount of chlorine, sulfur, and phosphorus gives them an acid-forming property, and the residue will have an acid reaction.

Base-forming foods include milk, vegetables, nuts, and all fruits except prunes, plums, and cranberries. The acid-forming foods are meat, fish, eggs, cereals, breadstuffs, prunes, plums, and cranberries. In the ordinary well-selected diet, the base elements probably predominate, although there is not complete evidence that this is a necessity.

Fruits and especially citrus fruits, even though acid to taste, are not acid-forming after reaching the tissues. The acids giving the sour taste to these foods are organic in nature and can be burned in the body, leaving a basic residue like the other base-forming foods. Even prunes, plums, and cranberries have an excess of basic over acidic elements and should leave a basic residue. However, these three fruits contain also an organic acid which the body cannot burn and which offsets the base present.

Calcium and Phosphorus

In the Body. Calcium and phosphorus are the chief mineral constituents of the skeletal framework of the body and the teeth. About nine-tenths of such structures are composed of these two minerals in the form of calcium phosphate. Three to four grams of calcium are present in the body, the largest part being in the bones and the smaller in soft tissues and fluids, particularly the blood. Phosphorus is widely distributed in the body in both hard and soft tissues and is a constituent of every living cell.

Functions. As a builder, calcium is an important constituent of such bony structures as the skeleton and the teeth. As a regulator, it assists in the coagulation of the blood, functions in the normal action of the heart, and acts as a body "coordinator" or "harmonizer."

Phosphorus, as a builder, is combined with calcium in calcium phosphate, an essential constituent of bones and teeth. It is also a part of every cell nucleus, particularly important in brain and nerve cells and necessary for cell multiplication. As a regulator, phosphorus helps in maintaining the neutrality of the blood, tissues, excretions, and secretions and in utilizing fats and carbohydrates. Both calcium and phosphorus promote growth. Their absence, limited amounts, or incorrect proportions result in stunted growth, poor tooth and bone development, and a disease known as rickets.

Requirements. Recommended daily allowances for calcium are given in Table 9, page 19.

Factors Affecting Absorption and Utilization. Complete absorption of the calcium consumed in foods is necessary if the body is to have the benefit of the calcium content of the diet. Factors in the intestinal tract unfavorable for absorption include excesses of fat and fiber in the food, alkaline instead of acid reaction in the upper intestinal tract, and the presence of oxalic acid in certain foods. Favorable to absorption are an acid reaction in the upper intestines and the presence of vitamin D. For complete utilization of the calcium and phosphorus after it reaches the blood stream, a correct ratio between the two, as well as the presence of vitamins C and D in the blood, is essential. An excess of phosphorus causes an increased calcium excretion. Tables 15 and 16 show good sources of calcium and

TABLE 15

Foods Rich in Calcium *

Excellent Sources	*Good Sources*
Amaranth	Almonds
Broccoli	Artichoke, globe or French
Buttermilk	Beans, common or kidney, dry or fresh, shelled; also snap and string
Cabbage:	Burdock, roots
Savoy and nonheaded	Cabbage, headed, especially green
Chinese, nonheaded varieties including tendergreens	Carrots
Chard	Celeriac
Cheese:	Celery
American or Cheddar	Cheese, cottage
Swiss	Chickpeas, whole
Clams	Chicory leaves
Collards	Cottonseed flour
Cress, garden	Crabs
Kale	Cream
Milk, whole or skimmed; evaporated, condensed, and dried	Eggs, whole
Molasses	Egg yolk
Mustard greens	Endive or escarole
Orach	Figs, dry
Sesame seed	Kohlrabi
Tendergreens	Leeks
Turnip tops	Lettuce, head or leaf
Water cress	Lobster
	Maple sirup
	Okra
	Oysters
	Parsnips
	Romaine
	Rutabagas
	Sorgo sirup
	Soybeans, dry or as green vegetable
	Soybean flour
	Sweet potato tops
	Turnips
	Vegetable oyster or salsif

Note: If the above foods were placed in order of importance, milk in its various forms (other than butter) would head the list of common foods, and green leafy vegetables would rate among the next best. . . . Certain plant foods, the calcium content of which was high enough to justify inclusion in this list, have been omitted because of their oxalic acid content. Beet greens, dock, rhubarb, spinach, and New Zealand spinach were left out on this account. If a food contains enough oxalic acid to combine with all of its calcium to form calcium oxalate, the evidence seems to show that the calcium is of little or no use to the body. This may be because the calcium oxalate is already formed in the food; or, it may be that the oxalic acid combines with the calcium during or after digestion, making it insoluble so that the body cannot utilize it. These same foods, of course, may be valuable for other elements than calcium.

* *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 276. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

TABLE 16

Foods Rich in Phosphorus *

Excellent Sources	Good Sources
Barley, whole	Almonds
Beans:	Artichokes, globe or French
Common or kidney, dry, shelled	Bamboo shoots
Lima, fresh or dry	Barley, pearled
Brazil nuts	Beans, mung, dry
Buttermilk	Broccoli
Cheese, Swiss	Brussels sprouts
Cottonseed flour	Buckwheat flour
Cowpeas, or black-eye peas, shelled	Cashew nuts
Crabs	Celeriac
Eggs, whole	Cheese:
Egg yolk	American or Cheddar
Fish	Cottage
Liver, any kind	Chickpeas
Lobster	Clams
Meats, lean or medium fat, having more than 12 per cent of protein	Cocoa
Milk, whole or skimmed; evaporated, condensed, and dried	Collards
Oysters	Corn, green, sweet
Poultry	Cornmeal, whole ground
Rice bran	Cress, garden
Rice polishings	Dasheen or taro
Sesame seed	Hazelnuts and filberts
Shrimps	Kohlrabi
Soybeans	Lentils
Soybean flour	Meats, fat, having more than 6 per cent of protein
	Millets
	Oatmeal or rolled oats
	Orach
	Parsnips
	Peanuts
	Peas
	Pecans
	Pistachio nuts
	Rice, brown
	Rye flour
	Walnuts
	Wheat:
	Flour, graham or whole-wheat
	Shredded or puffed
	Whole grain or meal
	Bran
	Germ

Note: There is a longer list of foods rich in phosphorus, and more food classes or groups are represented. Nearly all the calcium-rich foods contain significant quantities of phosphorus, and in addition lean meats, fish of all kinds, and several other classes of foods are rich in this element. All animal tissues except fat contain liberal quantities, and many grain products are among the better sources.

* *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 277. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

phosphorus, respectively, and Figure 10 compares the calcium contents of several foods.

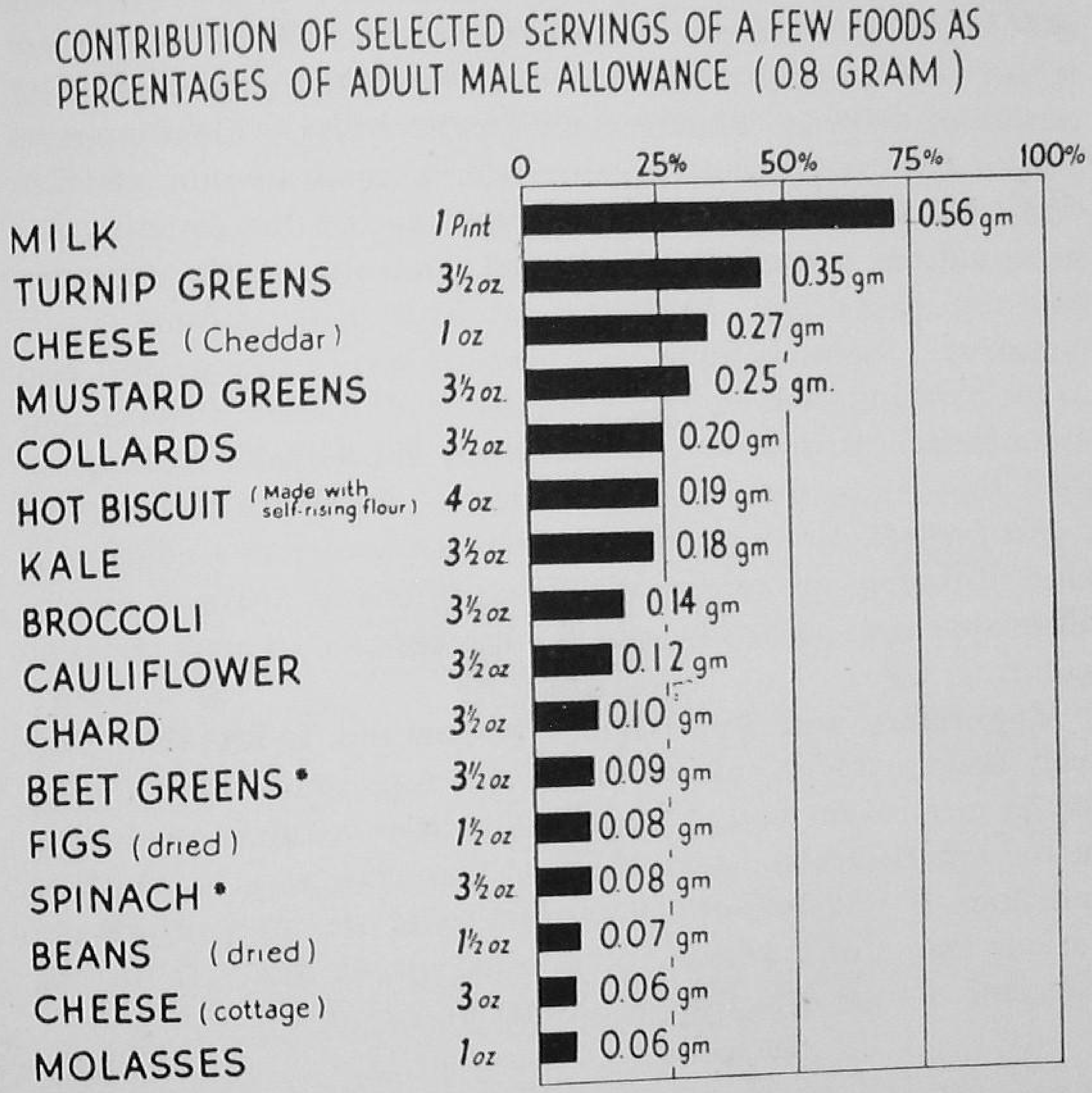

FIG. 10. Foods as sources of calcium. Milk is the most important common source of calcium. Food Charts, 1942. Courtesy, American Medical Association.

OTHER PRINCIPAL MINERAL ELEMENTS

Sodium and Chlorine. Sodium and chlorine occur in the body as sodium chloride (NaCl). Sodium salts are found in fairly large amounts in the blood and other fluids and in smaller amounts in the tissues. Chlorine is present in all body secretions and excretions and is in the hydrochloric acid of the gastric juice. Sodium chloride helps to maintain the normal osmotic pressure and regulates muscular movements.

About 2 grams of sodium chloride are needed daily by the

body. Since this substance is found in varying amounts in such foods as milk, eggs, meats, and vegetables, the body's requirements can be met by the foods of the ordinary diet without any addition of salt during the cooking process. However, the use of salt adds interest to foods and increases the consumption of certain of them by enhancing their palatability. There appears also to be a physiological reason why a small amount of additional salt is needed. The more potassium the diet contains, the more sodium is needed, as increased potassium intake increases excretion of sodium. Vegetables are high in potassium.

Sulfur. Sulfur is found as a part of body proteins and also in the hair and nails and is a component of thiamin, insulin, and glutathione. It is present in two of the amino acids making up food proteins, cystine and methionine. Adequate amounts of sulfur for body needs are supplied when the correct amount and kind of protein are consumed. The sulfur and nitrogen metabolism appear to be closely related. Proteins are about 1 per cent sulfur.

Magnesium and Potassium. Magnesium is found in the body associated with calcium in the skeleton; about three-fourths of the magnesium is thus found, and the remaining one-fourth in the soft tissues and body fluids. The exact way in which it functions is not known. Potassium salts are present in the various tissues of the body. The usual mixed diet will furnish sufficient of these minerals for normal nutrition.

Iron

In the Body. Iron is present in the body in a very small amount, less than one-tenth of an ounce, but it has extremely important functions. Most of the iron, about 80 per cent, is found in the hemoglobin, the substance giving red color to the red blood corpuscles in the blood. Smaller amounts are present in the muscles, liver, spleen, and kidneys. As there is no reserve store of iron in the body, it is important that the blood-forming organs receive, from the daily diet, sufficient iron to manufacture these red corpuscles.

Functions. As a builder, iron is an essential constituent of the hemoglobin; as a regulator, it controls vital activities. The iron affords to the pigment substance, hemoglobin, the ability

to transport oxygen to the tissues from the lungs (a requisite for life) and to transport carbon dioxide from the tissues to the lungs for excretion. These two processes constitute respiration. The complete absence from the diet of a reduced amount of iron and possibly other substances, such as copper, which appear to aid in hemoglobin formation, results in a disease known as anemia.

TABLE 17

FOODS RICH IN IRON *

Excellent Sources	*Good Sources*
Apricots, dried	Barley, whole
Beans:	Beans, snap or string
Common or kidney, shelled	Brains
Lima, shelled, fresh or dry	Broccoli
Beet greens	Brussels sprouts
Broccoli leaves	Cabbage greens or outer leaves
Chard	Collards
Cowpeas, shelled, dry or fresh	Cornmeal, whole ground
Dandelion	Dates
Eggs, whole	Dock or sorrel
Egg yolks	Endive or escarole
Heart	Figs, dried
Kale	Leaf lettuce
Kidney	Meats, fat (beef, veal, pork, lamb), over 10% protein
Lentils, dry	Oatmeal or rolled oats
Liver	Peas, green or dried, whole seeds
Meats, lean or medium fat (beef, veal, pork, or lamb), over 15% protein	Poultry, light meat
Molasses	Prunes, dried
Mustard greens	Rye flour, whole
New Zealand spinach	Seedless raisins, or currants
Oysters	Sugarcane sirup
Peaches, dried	Vegetable oyster or salsify
Poultry, especially dark meat	Whole-wheat cereals
Shrimps	Whole-wheat flour
Sorgo sirup	
Soybeans, dry or as green vegetable	
Spinach	
Tongue	
Turnip greens	
Water cress	
Wheat bran	

* *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 278. Courtesy, *Bureau of Human Nutrition and Home Economics*, United States Department of Agriculture.

Requirements. Recommended daily allowances for iron are given in Table 9, page 19.

Factors Affecting the Availability and Utilization. Any condition that affects the intestinal functioning will affect the absorption of iron. The reaction of the intestines, the form in which the iron is ingested as well as the amount of fiber, may interfere with the absorption. In the blood, the presence of copper affects the best use of the iron which has reached the blood stream. Calcium also favors the utilization of iron.

Sources of Iron. Table 17 shows foods rich in iron. Figure 11 compares foods as sources of iron.

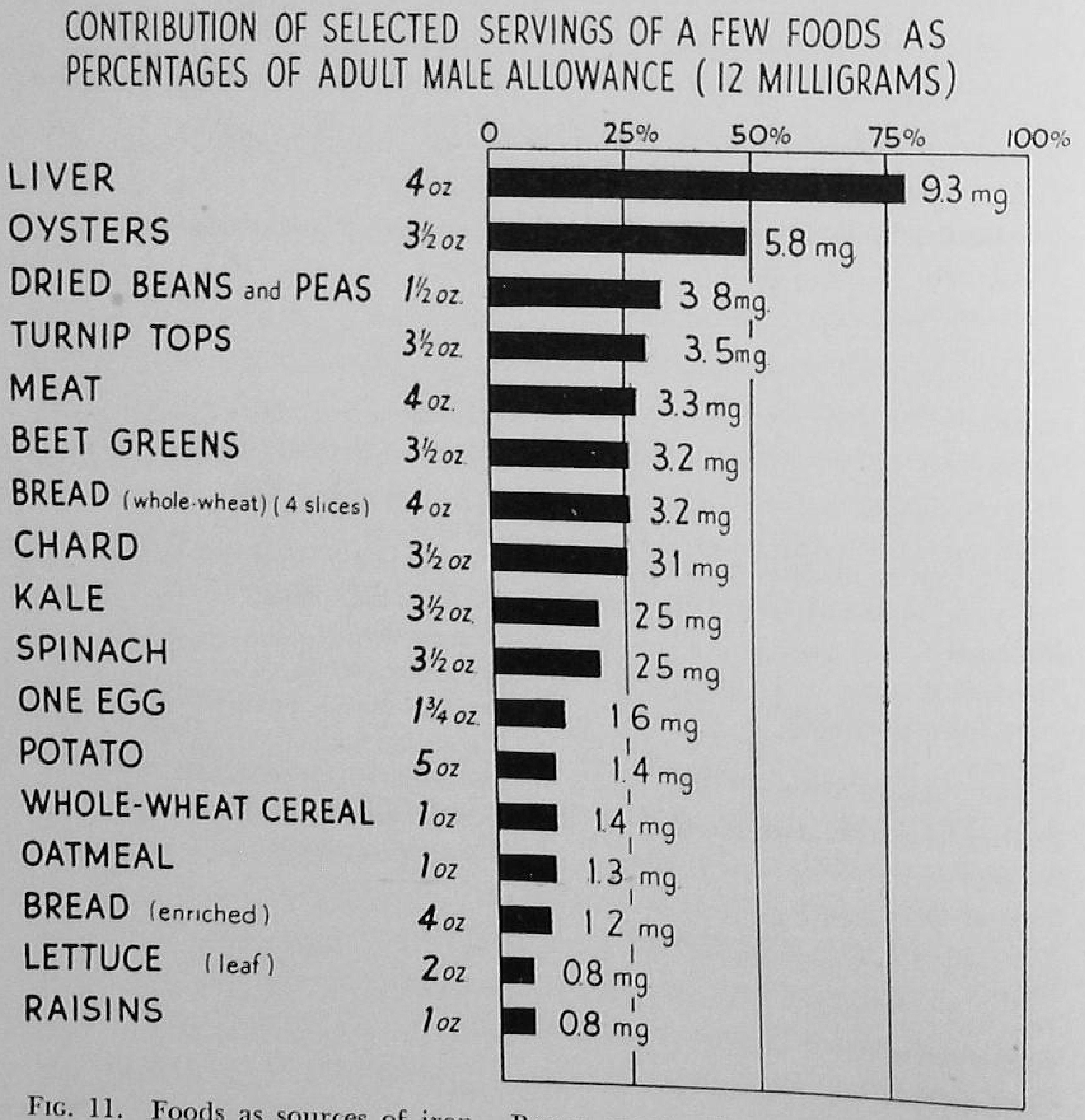

FIG. 11. Foods as sources of iron. Beans, meats, the green leafy vegetables, and nutritionally unimpaired cereals are the best common sources of iron. Food Charts, 1942. Courtesy, American Medical Association.

Iodine

In the Body. Iodine is an essential element in the body, but it is present in such small amounts that it is hard to measure. Like iron, it has a function out of all proportion to the amount present. The body contains about 25 milligrams of iron, 15 of which are in the thyroid gland, the principal storehouse.

Functions. As a builder, iodine is an essential constituent of thyroxine, a substance produced by the thyroid gland. As a regulator, in the form of thyroxine, it controls the energy metabolism of the body, regulating the rate of oxidation in the tissues. When the body lacks iodine, the energy metabolism is slowed down, the thyroid gland enlarges, and a goiter results. Iodine is also necessary for normal growth.

Requirements. The body has a very small but definite nutritive requirement for iodine. The daily amount needed has been estimated at about 0.002 to 0.004 milligram a day for each kilogram of body weight, which amounts to about 0.15 to 0.30 milligram daily for the adult. This requirement covers the daily losses through excretion and the maintenance of a reserve which is needed by the hormone of the thyroid gland and is easily met by the regular use of iodized salt; its inclusion in the diet is especially important in adolescence and pregnancy.*

Sources. Iodine is fairly widely distributed throughout nature. It is found in nearly all living things and in the water, air, soil, and rocks. The sea salt and spray that evaporate in the air are rich in iodine, as are such foods of the sea as kelp, seaweed, and fish; those cereals, fruits, vegetables, and milk that are produced near the sea are also richest in iodine. In so-called goitrous areas, where the air, salt, and foods do not contain iodine, it may be given medicinally to prevent the development of goiter. Much of the commercial salt, known as iodized salt, has this element added in the process of manufacture.

It is estimated that an individual eats about 6.2 grams of salt daily. If this is iodized salt, the amount represents about 620 micrograms of potassium iodide (KI) or 474 micrograms of iodine.

* See Table 9, page 19.

Other Trace Elements

Copper. Copper is now recognized as an important factor in the utilization of iron in the formation of hemoglobin. The amount present in the body has been estimated at about 100 to 150 milligrams, with most of it contained in the muscles, bones, and liver, and only a small amount in the blood.

Although a copper deficiency is rarely found in human beings, there appears to be a definite daily requirement. The adult daily requirement for copper is thought to be around 1 to 2 milligrams; that of infants, approximately 0.05 milligram per kilogram of body weight. The copper requirement has been estimated to be approximately one-tenth of that for iron.* When the iron requirement is met, the copper requirement is also considered to be met since the best sources of copper are the iron-containing foods. Iron and copper are found in about equal amounts in the leafy vegetables, legumes, and root vegetables. High in both iron and copper are liver, oysters, molasses, chocolate, and cocoa. Poultry is superior to beef in copper.

Manganese, Cobalt, Zinc, Fluorine, Selenium, Boron, Aluminum. Although the first three minerals have been demonstrated to be essential to all animal life, very little is known regarding their requirement. They have been reported to occur in animal tissues. The significance of the last four to human nutrition is uncertain.

Availability and Utilization of Food Minerals in the Body. Many factors determine whether or not the mineral content of foods will be completely available to the body. One of the most important of these is food preparation. The quantity of minerals in the cooked product is greatly diminished by soaking vegetables preparatory to cooking and discarding the water, throwing away liquids from canned foods, eliminating the water in which dried foods have been soaked, paring foods thickly, and cutting foods in very small pieces. Some calcium and phosphorus will be lost when milk is heated, as it remains in the coating left on the cooking utensil and in the skin formed on the top. To avoid this, milk should be stirred during its heating. In the preparation of strained fruit juices, minerals may remain

* See Table 9, page 19.

in the discarded pulp. The commercial manufacture of white flour removes most of the iron from wheat.

Other factors determining whether minerals are completely utilized by the body are the presence in the diet of adequate vitamins, the amount of non-digestible residue, the complete digestion of the substances with which the minerals are associated, the action of base-forming elements of the food, and the proper functioning of the digestive tract.

WATER

Composition. In composition, water is the simplest of foodstuffs, as it is made up of but two elements, hydrogen and oxygen. Though water is not capable of yielding energy because it contains no unoxidized hydrogen, yet its functions in the body are of such vital importance that it must be considered a very essential foodstuff. It has been said that the body could lose about all its stored carbohydrate and fat and about one-half of its protein without great danger to life, but a loss of one-tenth of its supply of water would have undesirable effects and if one-fifth were lost, death would result.

In the Body. Two-thirds of the body weight is made up of water, a fundamental part of every cell. The tissues in the body which function actively, as the lungs, heart, muscles, blood, and kidneys, contain more water than others. During the growing period, a larger percentage of water will be present in the body.

Water is continually being lost in the form of urine from the kidneys, in moisture in the air from the lungs, and in perspiration from the skin, about two quarts being lost daily. Usually the greater part of elimination is from the kidneys, but in hot weather much is eliminated through the skin. This loss is made good by the fluids in the diet, the moisture in the foods eaten, and the water formed in the body by the combustion of foodstuffs.

Functions of Water. Water serves as a building material, giving firmness and elasticity to the tissues, and constitutes about four-fifths of the blood. It acts as an important solvent, carrying the nutriments, sugars, amino acids, fats, minerals, and vitamins in the blood and lymph to all the tissues and similarly conveying waste material to the organs through which it is disposed

of. It helps also to maintain the fluidity of certain portions of the body. In addition, water acts as a stimulant and regulating substance by stimulating the production of gastric juice in the stomach and by aiding digestion and absorption of food from the intestine. As a regulator of body temperature by evaporation, water performs one of its most important functions and keeps the various salts in a state of proper dilution as well.

Requirement for Water. The amount of water required by the body is exceeded by the requirements for one other substance only, namely, oxygen; this amount varies, being dependent upon the surrounding temperature, the amount of muscle activity indulged in, and the nature of the food eaten. The daily requirement is about six to eight glasses. About one-fourth of this amount is obtained from food, a small amount is produced in the body, and the remainder is taken in the form of fluids. In all probability, nearly everyone consumes far too little water, and, unless a conscious attempt is made to drink water during the day and at meal times, the diet will be deficient in this respect. An adequate supply of water is a principle of nutrition. Water may safely be drunk during a meal provided it is not too cold, is taken in moderation, and is not used for the purpose of washing down food.

Water in Food. All foods, no matter how dry they appear to be, contain some water; certain vegetables have as much as 94 per cent. The keeping qualities of all foods depend largely upon their water content. Those foods that have more than 20 per cent cannot be stored easily because of their tendency to mold, and flours and cereals that are to be kept any length of time must have a water content lower than 10 to 12 per cent.

QUESTIONS AND ACTIVITIES

1. Minerals are said to play a double role in nutrition. Explain the meaning of this statement.

2. Compare the calcium content of foods by determining the amount of calcium in 100-gram portions or average servings of 10 to 20 calcium-rich foods listed in Table 15. Arrange these foods as an exhibit and discuss.

3. Set up an exhibit of calcium equivalents.

4. Weigh and display amounts of foods which furnish approximately one-tenth of the adult daily requirement for calcium. Determine and

record the amount of each in cups, in tablespoons, or in size and number of pieces. Which are the best sources of calcium? Do you eat enough calcium daily? Estimate for each of the above foods the part of an average serving it represents and the approximate amount of calcium in the average serving.

5. Compare the phosphorous content of foods by determining the amount of phosphorus in 100-gram portions or average servings of some phosphorus-rich foods listed in Table 16. Arrange these foods as an exhibit and discuss.

6. Weigh and display amounts of foods which furnish approximately one-tenth of the daily phosphorous requirement of an adult. Determine and record the amount of each in cups, tablespoons, or number and size of pieces. Which are the best sources of phosphorus? Do you eat enough phosphorus daily? Estimate for each of the above foods the part of an average serving it represents and the approximate amount of phosphorus in the average serving.

7. Compare the iron content of foods by determining the amount of iron in 100-gram portions or average servings of some of the iron-rich foods listed in Table 17. Arrange these foods as an exhibit and discuss.

8. Weigh and display amounts of foods which furnish approximately one-tenth of the adult daily iron requirement. Determine and record the amount of each in cups, tablespoons, or number and size of pieces. Which are the best sources of iron? Do you eat enough iron daily? Estimate for each of the above foods the part of the average serving it represents and the approximate amount of iron in the average serving.

9. Set up an exhibit of iron equivalents.

10. Using the various lists of foods suggested in the previous activities, outline three different ways of including enough calcium and phosphorus in the daily diet. In the first plan, use 1 pint of milk and other foods; in the second, 1 cup of milk and other foods; in the third, ½ cup milk and other foods. Figure the cost of these three lists of foods. What conclusions can you draw from this study?

11. List all the possible ways for adding calcium to the diet: in first courses of meals, in main courses, in salads, in desserts, in the extras at the meal.

12. Outline three different ways to include sufficient iron in the diet. In the first list, use meat and egg; in the second, egg but no meat; in the third, neither meat nor egg. Figure the cost of these three lists of foods. What conclusions can you draw from this study?

13. Formulate general rules to follow in choosing one's food to insure the right amount of all minerals in the diet.

14. List all the important considerations in the cookery of food to insure the maximum retention of all minerals.

15. How much calcium, phosphorus, and iron do you need daily? Plan a day's menu for yourself which will furnish the sufficient amounts of each of the minerals.

16. Study your diet record assembled in Activity 4, Chapter I. Is it adequate in calcium, phosphorus, and iron? If not, what suggestion can you make for improving it?

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CHAPTER V

VITAMIN REQUIREMENTS FOR REGULATION AND PROTECTION

VITAMINS A, D, E, AND K

Discovery of the Vitamins. Vitamins are the newest additions to the list of nutrients now known to be required daily by the body. They were unrecognized until twenty-five to thirty years ago when scientific workers observed that artificial mixtures of the chemical foodstuffs discovered up to that time, no matter how scientifically selected and combined, failed to promote growth in the young animal, but that, by adding to the diet minute amounts of such foods as butter or milk, growth was at once stimulated and then proceeded in a normal manner. This observation led to the belief that there must be, in natural foodstuffs, something besides proteins, fats, carbohydrates, minerals, and water.

For many years previous to the discovery that vitamins were new substances, it was common knowledge that certain diseases could be cured simply by making very minor changes in the diet. For example, scurvy had been prevented by adding orange juice, beriberi by substituting unpolished rice for the polished variety.

In 1912, a scientist by the name of Casimir Funk, who was interested in these substances which could prevent disease, coined the term vitamine for them. Shortly after, the *e* was dropped in the spelling of the word.

Naming the Vitamins. As each new vitamin was discovered, it was given an alphabetical designation, five letters being originally used. With the discovery of still more of these substances, the number of letters had to be increased. Some of the original letters were given sub-numerical designations as a vitamin, thought to be a single entity, proved to have one or more parts. As each vitamin was isolated and its chemical formula determined, it became evident that each of these substances was a

different chemical entity with specific chemical reactions and that the term vitamin was not a good group name for such widely differing products. Now names which indicate the chemical nature are replacing the alphabetical designation for most of the vitamins.

How Vitamin Values Are Determined and Expressed. When the nutrients now known as vitamins were first recognized, the only way which the scientist could judge them was in terms of the effect of their presence or absence in the diets of experimental animals. The amount of a substance which would prevent a disease, cause a certain rate of growth, or prevent certain symptoms was said to contain a unit of the vitamin. This is spoken of as a biological unit since this method of measuring vitamins with animals is called a biological method or bio-assay. Many of the biological units are referred to as Sherman units since several of the biological methods were developed in Dr. Sherman's laboratory at Columbia University.

Practically the same procedure is followed in testing any vitamin by the biological method. Some standard test animal is used. This may be a dog, pigeon, guinea pig, chicken, or, more frequently, a white rat. The white rat is the most popular animal used for experimental purposes for several reasons: the advantage of its small size both for handling and for the space required for experiments, the low cost of feeding rats, the rapid life cycle of rats so that one human investigator can observe many generations and effects of diet, etc., the similarity of rats' physiology and metabolism to that of the human being, and also the knowledge of the history of the white rat because of the standardization done by Dr. Donaldson of the Wistar Institute.

Whatever the animal chosen, a large number of them are fed a diet free of the vitamin to be studied but adequate in every other respect. This is called a basal diet. When the animals show a characteristic deficiency from the lack of the vitamin omitted from the diet, they are divided into groups of at least ten and each group is fed daily a different weighed amount of the food to be tested over a given length of time. Then the amount of the food that will accomplish a particular result, which is set up as a criterion in the case of each vitamin, is considered to furnish a biological unit of the vitamin being studied. For example, a daily weight gain of so many grams may be

taken as the criterion; or the amount which will prevent or cure the deficiency disease.

While biological methods have told us a great deal about the vitamin content of foods as well as their functions, there are certain reasons why they do not produce the most accurate kinds of results. In 1931, a conference to study standards for vitamins was sponsored by the League of Nations. At this conference certain standards in terms of specific amounts of definitely known sources were established for vitamins A, B, C, and D. It was also agreed to express these standards as International Units. This same unit has been adopted by the United States Pharmacopoeia; therefore, 1 International Unit (or I.U.) is equivalent to 1 United States Pharmacopoeia Unit.

As the chemical nature and reactions of a vitamin are discovered, it becomes possible to use accurate chemical methods in place of the somewhat less accurate biological methods, and the presence of vitamins in foods can then be expressed in definite weights as in grams, milligrams, and micrograms. Since, in some instances, only parts of grams of some vitamins are present in foods, vitamins are now more commonly expressed in milligrams. One milligram is one thousandth part of a gram. Occasionally tables of vitamin values will be expressed in terms of micrograms. A microgram is one thousandth part of a milligram. To change from micrograms to milligrams, simply move the decimal point three places to the left. The term gamma is sometimes used in place of microgram. Ten gamma would be the same as ten micrograms.

Vitamins A and D are preferably expressed in International Units; vitamins B_1, G, C, and nicotinic acid in milligrams. In addition to these biological and chemical methods for vitamin study, other procedures of a physical or so-called microbiological nature have been developed.

Vitamins Recognized Today. Some of the more important vitamins which are being studied today fall into the two groups shown on page 66.

Vitamins as Body Regulators. Vitamins are classed as body regulators because they promote normal growth and development; insure the best condition of general health by promoting better tissues, strength, stamina, endurance, nervous stability, and normal functioning of the digestive tract as well as other parts

Fat-Soluble Vitamins	Water-Soluble Vitamins
Vitamin A and its precursors	*Vitamin C, ascorbic acid*
Vitamin D	*Vitamin B_1, thiamin or thiamine*
Vitamin E	*Vitamin B_2, riboflavin*
Vitamin K	*Nicotinic acid, niacin*
	Vitamin B_6, pyridoxine
	Pantothenic acid
	Para-amino benzoic acid
	Choline
	Biotin
	Inositol
	Vitamin P, citrin
	Grass-juice factor and milk factor
	Possibly folic acid

Note: The vitamins printed in italic type above are considered, without any doubt, essential for human nutrition; more work needs to be done on the others before it can be definitely stated that they are absolute requirements for human nutrition. It is considered that the daily intake of foods which will provide sufficient amounts of vitamins A, D, C, B_1, B_2, and niacin will also insure adequate amounts of the others as well. Only those vitamins italicized and vitamin E will be considered in detail in this book.

of the body; assist the utilization of foodstuffs; improve resistance to disease, infections, and certain deficiency diseases; and promote reproduction and lactation. All vitamins have these general functions but each plays a very specific role as well.

Extreme deficiencies of each or several of the vitamins in the diet produce such specific deficiency diseases as scurvy and beriberi. These diseases are not too common in this country and are not considered to constitute a very serious nutritional problem. When they do occur, they have such very characteristic symptoms that they can easily be detected and quickly treated by the physician.

Diets not completely lacking but slightly deficient in the vitamins may produce a more serious problem because the characteristic symptoms are less specific and may be overlooked or wrongly diagnosed. These less well-defined deficiencies are referred to as latent or sub-critical or sub-clinical. In recent years there have been discoveries of certain apparatuses and techniques by means of which the trained person can detect certain body changes which are forerunners of the deficiency diseases themselves and as a result of which treatment may be begun immediately. These

so-called latent disorders are a very great detriment to the best health level of human beings.

Factors Affecting Vitamin Content of Foods. Among factors affecting the vitamin content of foods are the following: variety of the food itself, some varieties of the same food having more or less of the vitamin in question; soil variations and climate, the same food grown on one type of soil and in a certain climate varying in vitamin content from the same food grown elsewhere; degree of maturity, some foods having more vitamin content when ripe, others when underripe; type of diet fed to animals used as food; storage after harvesting or production, which has a destructive effect; freezing processes resulting in loss of vitamins caused by the preliminary blanching; drying resulting in certain losses; canning causing less loss in acid foods than in non-acid foods; and cooking of the foods, thereby affecting their vitamin content.

How to Conserve Vitamins in Food Preparation. It is impossible to consume all vitamin food sources in the raw state. However, certain procedures in the preparation of foods will minimize loss of vitamins. While specific vitamins may be affected differently by the same condition, there are general procedures which help in the conservation of vitamin values.

Foods need to be stored at low temperatures and in closed containers. In preparing foods to be eaten without cooking, fruits and vegetables should be chopped, shredded, crushed, or cut up as near the time of serving as possible. They lose less vitamin content if stored in the refrigerator, covered. Frozen foods that are to be consumed raw should be served immediately after thawing, in a slightly frozen state, if possible.

Long cooking processes are more destructive than shorter ones, frying being the most destructive and baking only slightly less so. Stewing is more destructive than short boiling. While steaming and waterless cooking methods may cause less of the water-soluble vitamins to be dissolved, the more rapid boiling may help to prevent the oxidation of certain vitamins. Pressure cooking, although causing the food to be cooked at an extremely high temperature that is destructive generally, is done so quickly that any destructive effects of the high temperature may be canceled by the very short cooking time.

In boiling foods, the following procedures are helpful in re-

ducing vitamin losses to the minimum. Cook without peeling whenever possible. If peeling foods, do so just before the time they are to be cooked. Don't soak foods before cooking. Start the food to cook in boiling water and bring the water back to boiling as quickly as possible. Use as little water as possible. If cooking frozen foods, cook without thawing; drop into boiling water. Cook as quickly as possible. Don't stir air into foods while cooking. Don't put foods through the sieve while they are hot. Use the water in which all foods are cooked. Use liquids off canned foods as well. Avoid reheating of foods.

Vitamin Concentrates Versus Vitamin Foods. Synthetic forms of single vitamins as well as mixtures of several of them are available from the drugstore. Millions of dollars are spent annually by the American public on these products in the form of tablets, capsules, etc. Since only those vitamins which can and have been synthesized can be made available in this form, it is obviously impossible to obtain all the vitamins already discovered and also those which may be just as important but yet undiscovered.

It is more desirable, therefore, for the average person to depend upon natural food sources for his daily supply of vitamins. This is entirely possible if the right selection of foods is made daily. Where it is necessary for the diet to be restricted in some way or another (and this is a medical problem, not a nutritional problem, and should be attacked by a physician only) the physician may find it desirable to supplement the foods in the dietary with some of the synthetic forms of vitamins. In any case, they should always be used in addition to, and not in place of, the natural sources of the vitamins which may also contain other important dietary components necessary for normal vitamin functioning.

Vitamin A

Discovery. The presence in foods of vitamin A was discovered when the difference between the fat of milk or egg yolk and that of lard or vegetable oils in promoting growth in animals was noted. Butter and egg yolk favor normal growth, but little, if any, growth is observed with the use of olive oil or lard.

What Vitamin A Is. The vitamin A value of foods is due either to the presence in them of a fat-soluble substance (vitamin

A itself) or several fat-soluble pigments that have no vitamin A value themselves but that can be converted into vitamin A by the animal body (presumably in the liver). Vitamin A is found in animal fats. Two forms of vitamin A have been reported: one, A_1, in the oil of the liver of salt-water fish, and the other, A_2, in that of fresh-water fish. The pigments, three called carotene (*alpha, beta, gamma*) and one called cryptoxanthin, are present in plant foods and known as the precursors of vitamin A. Both vitamin A and the pigments contain the elements carbon, oxygen, and hydrogen. Carotene is the more complex substance. One molecule of *beta*-carotene is converted in the body into two molecules of vitamin A. Figure 12 is an illustration of vitamin A.

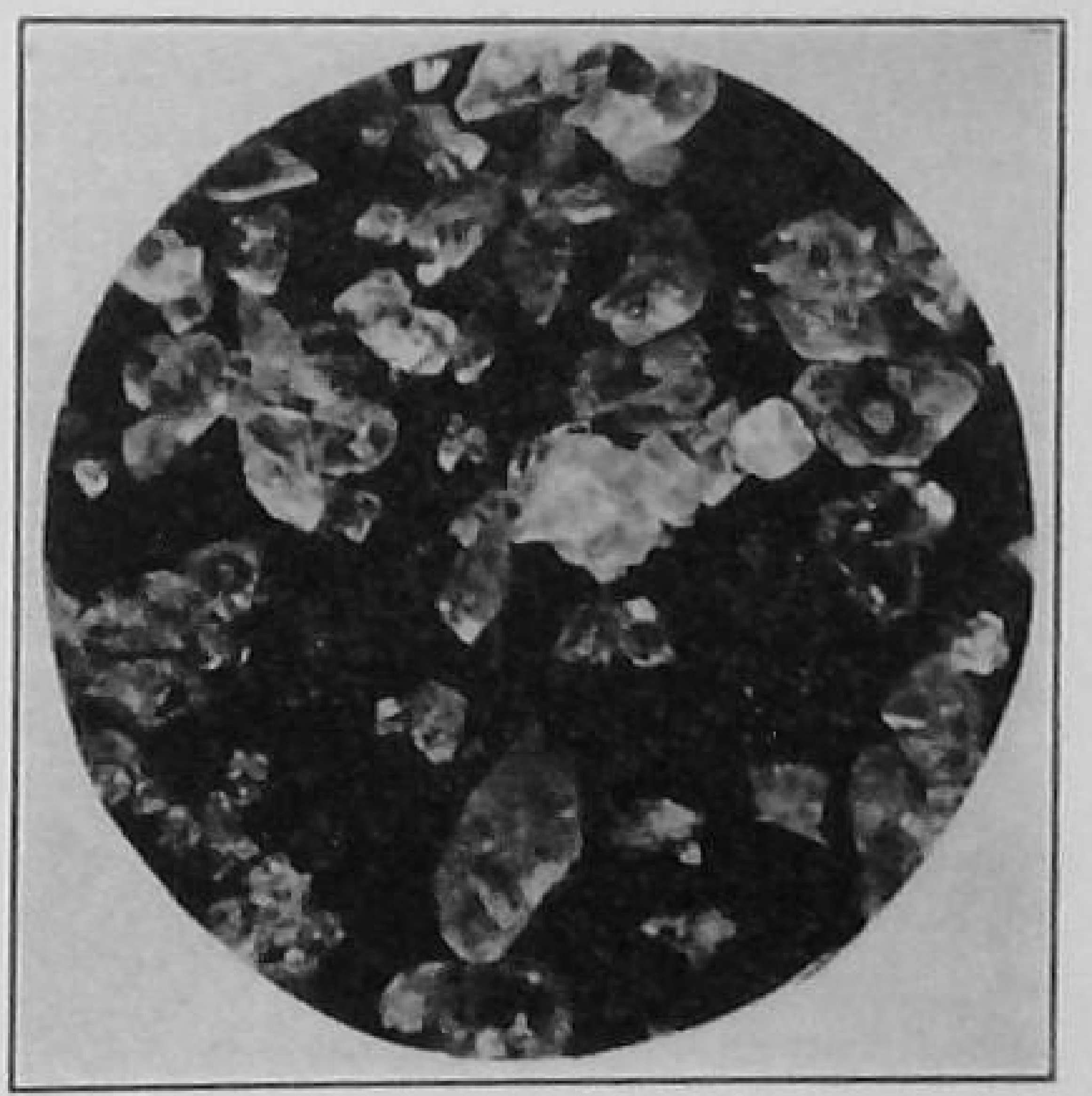

FIG 12. Vitamin A. Courtesy, E. I. Squibb Company.

How Vitamin A Is Measured and Expressed. Rats are used for measuring the vitamin A value of foods biologically. A biological or Sherman unit of vitamin A is the amount that will allow a gain of 3 grams per week over a period of 8 weeks in a standard test rat receiving a diet adequate in all respects but vitamin A.

An International Unit of vitamin A is equivalent to 0.0006 milligram or 0.6 microgram of *beta*-carotene. One International Unit is the same as one United States Pharmacopoeia Unit. The vitamin A requirement and content in foods are expressed in International Units. One Sherman Unit is equivalent to 0.7 International Unit. To convert Sherman Units to International Units, multiply by 0.7.

Nutritional Significance of Vitamin A. The growth-promoting functions of vitamin A have already been mentioned. The normal growth and development of all young animals are dependent upon the presence of sufficient amounts of vitamin A during the growing period. Vitamin A is a necessity in the diet at all ages for another reason. Certain parts of the body, such as the skin, alimentary tract, genito-urinary tract, and reproduc-

tive organs, are composed of a special type of tissue known as epithelial tissue. Vitamin A is necessary for the normal structure of this tissue, which has been called the body's first line of defense. When vitamin A is absent, these cells change in appearance as well as function so that they can no longer protect the body from infections of one kind or another.

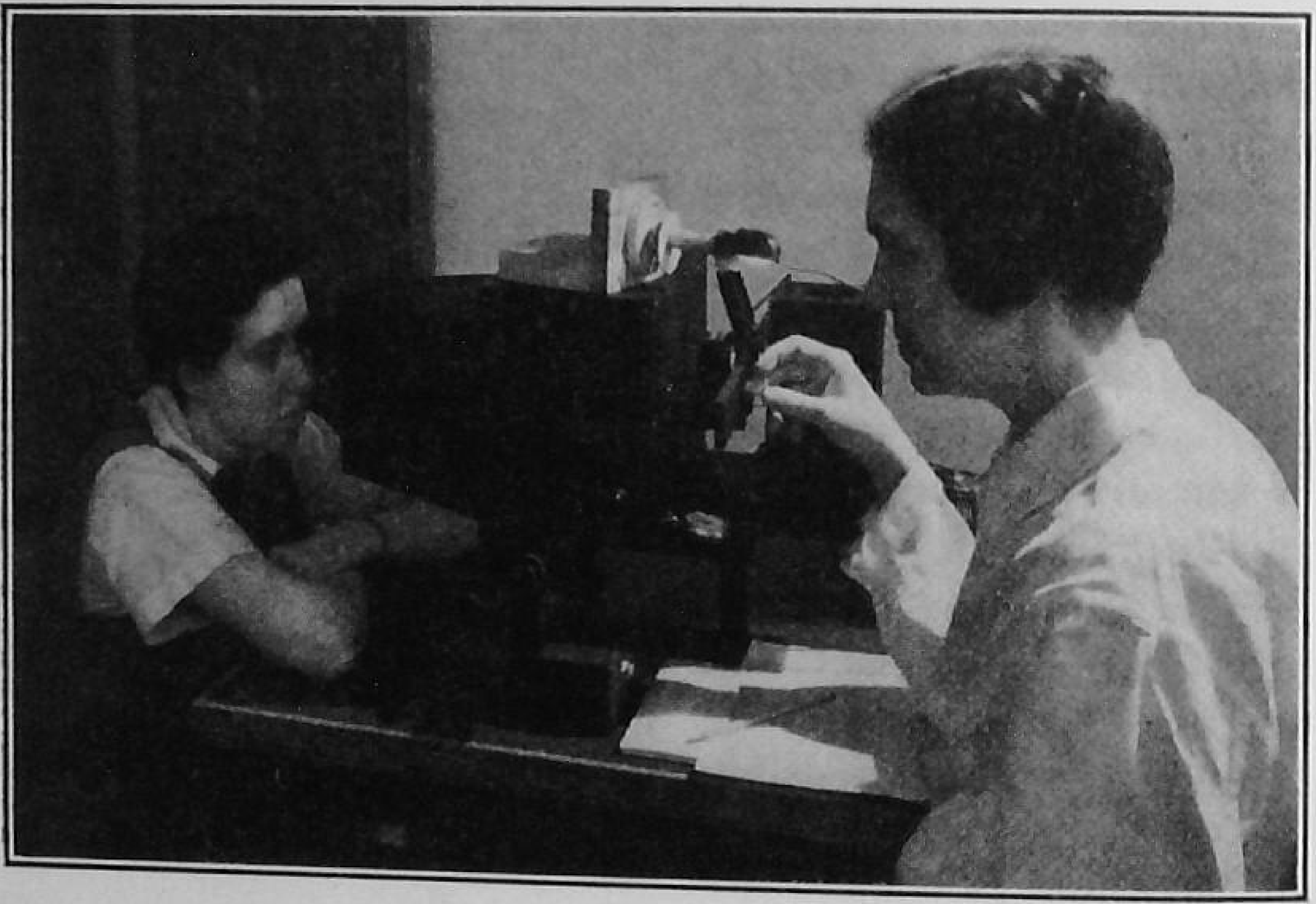

FIG. 13. Testing for night blindness. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

Vitamin A also plays an important part in preventing night blindness. When the eye is exposed to the light, a certain substance called the visual purple is bleached. Vitamin A brings about a regeneration of this visual purple with the result that a person who has adequate supplies of vitamin A can adapt very quickly to changes in the intensity of the light which strikes the eye. Night blindness is the earliest symptom of vitamin A deficiency to occur. With an extreme deficiency, a disease of the eye known as xerophthalmia results. An apparatus called the photometer detects night blindness and gives some idea as to whether or not there is a sufficient supply of vitamin A in the body. Scientists can also measure the amount of vitamin A in the blood plasma. Figure 13 shows testing of the eyes for night blindness.

Requirements for Vitamin A. The human body has great capacity for storing vitamin A, about 90 per cent in the body being stored in the liver. Because of this, the effects of shortages in the diet are not always immediately noticed. A daily intake of vitamin A is required to keep the stored amount up to the best level. Smaller daily doses of the vitamin are more effective than massive single doses. Carotene is absorbed less readily than vitamin A and requires bile for its absorption. Liquid petrolatum interferes with the absorption of vitamin A and carotene so it should never be given after meals. Good intestinal absorption is a prerequisite for the fullest utilization of both vitamin A and carotene.

TABLE 18

FOOD SOURCES OF VITAMIN A AND PRO-VITAMIN A *

Products	*Excellent Sources*		*Good Sources*	
Animal products	Fish-liver oils	Egg yolk	Cream	Milk, whole
	Liver	Butter	Kidney	Red salmon
	Fish roe	Cheese	Oysters	
Vegetables	Kale	Chinese cabbage	Asparagus, green	
	Spinach	Broccoli	Okra	
	Dandelion greens	Mustard greens	Brussels sprouts	
	Dock	Beet greens	Artichokes, globe	
	Escarole	Carrots	Tomatoes, yellow	
	Chard	Sweet potatoes		
	Lamb's quarters	Squash, yellow		
	Turnip tops	Peppers, sweet		
	Lettuce, green	Tomatoes, red		
	Collards	Peas, green		
	Water cress	Beans, green		
Fruits	Apricots		Avocados	Pineapple
	Papayas		Guavas	Olives, green
	Mangoes		Cantaloupe	Olives, ripe
	Prunes		Blackberries	Dates
	Peaches, yellow		Black currants	Oranges, deep yellow juice
			Blueberries	
			Bananas	
Cereal			Cornmeal, yellow	

* *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 288. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

Recommended daily allowances for vitamin A are given in Table 9, page 19.

Sources. As already stated, the vitamin A value of a food is caused by the presence of either vitamin A itself or a precursor.

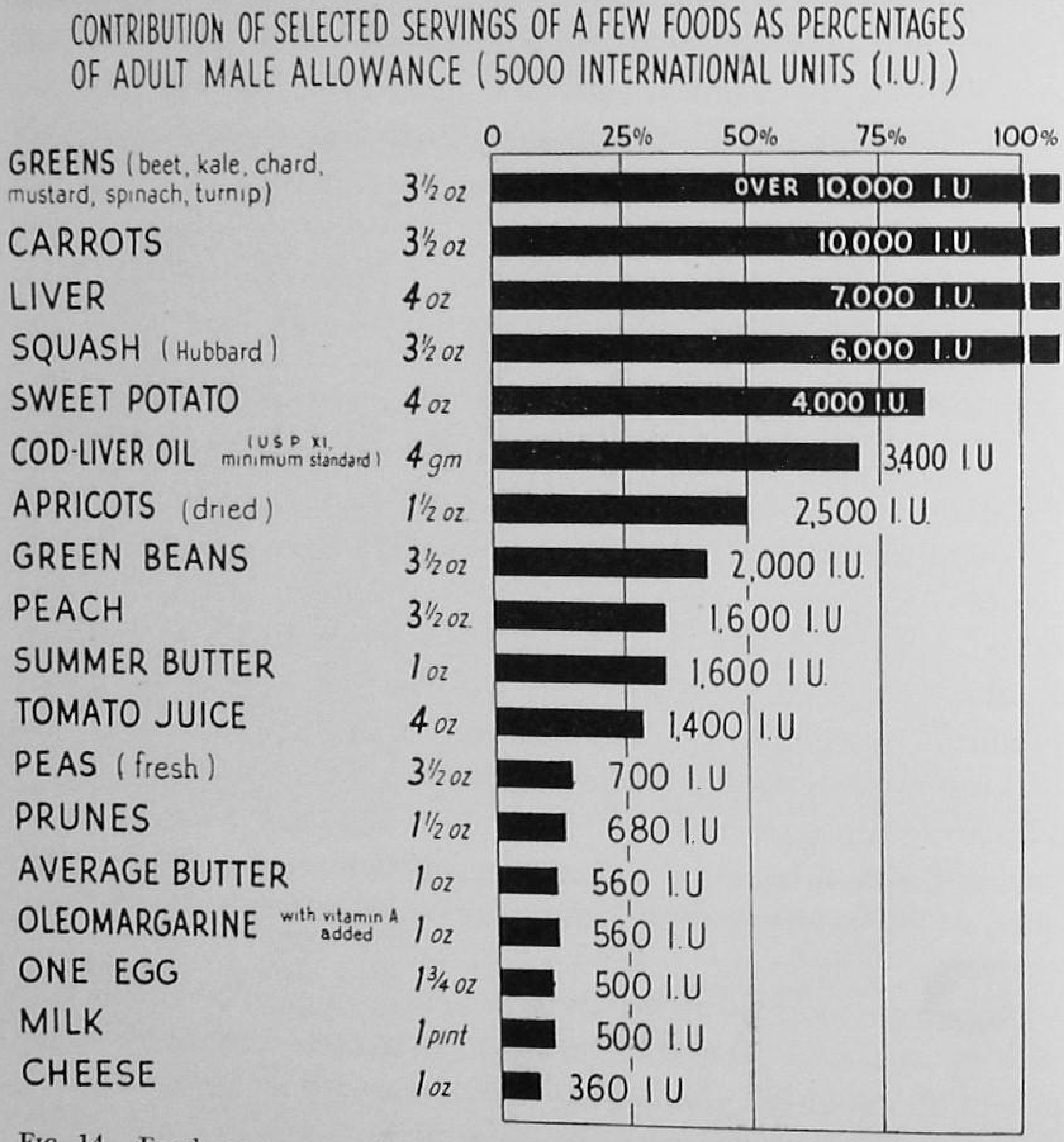

FIG. 14. Foods as sources of vitamin A. Green, leafy, and yellow vegetables are outstanding sources. Dairy products, eggs, and liver (and fish-liver oils) are the important animal sources. Vitamin A is well conserved in cooking. Food Charts, 1942. Courtesy, American Medical Association.

Vitamin A is found in milk, fat, egg yolk, butter, liver, and fish-liver oils. The precursors of vitamin A occur widely in the plant world. Carotene is the substance giving the color to most of the yellow foods; it is not soluble in water. It is chiefly associated with the green coloring, chlorophyll, in vegetables and the red coloring in tomatoes. Green and yellow plant sources

are the richest sources of this precursor. The body converts the precursors into vitamin A, probably by means of an enzyme in the liver. Table 18 lists foods with high vitamin A value. Figure 14 compares the vitamin A value of several foods.

Effect of Heat, Oxidation, Etc. Vitamin A is fairly stable to heat but may be destroyed by oxidation. Boiling apparently has no undesirable effect, but foods exposed to the air or heated for a very long period of time may show a large loss. The value is maintained in canned foods and in frozen foods which are kept in the frozen state. Some of the value may be lost in drying and still more during the storing of dried foods. Sulfur-dried foods retain vitamin A better than foods naturally dried.

Vitamin D

Discovery. A bone disease known as rickets and its cure through fish-liver oils or cod-liver oil have been known for centuries. Experimentally, it was first produced in puppies and cured with cod-liver oil by an English scientist, Dr. Edward Mellanby, in 1918. Since cod-liver oil was a good source of vitamin A, it was naturally assumed that one of the functions of vitamin A was the curing of rickets. When Dr. McCollum subsequently discovered that cod-liver oil, which had had its vitamin A destroyed with oxidation, still cured rickets, the presence of an additional vitamin (this time one effective for the curing of rickets) could not be doubted.

Associated with this discovery came the later ones of the possibility of curing rickets with artificial light and the possibility of producing this vitamin in certain foods by their exposure to the ultra-violet rays of natural or artificial sunlight. Since this time, vitamin D has been secured and synthesized in crystalline form.

What Vitamin D Is. Fats in the cells and tissues of plants and animals have associated with them some substances referred to as sterols. Some of these sterols possess antirachitic potency and the term vitamin D is applied to such sterols. Ten such substances are known. The chemistry of five of them has been determined, but only two need to be studied in human nutrition. These include ergosterol, the chief vitamin D precursor in plants which, when activated by ultra-violet light, becomes D_2, known

as calciferol. (Viosterol is the trade name for activated ergosterol dissolved in oil.) The chief vitamin D precursor in animals, 7-dehydro-cholesterol, yields vitamin D_3 upon activation with ultra-violet light. This is the natural form of vitamin D found in fish-liver oils and eggs and in the human body when the sterol in the skin is converted to vitamin D by artificial or natural sunlight. Vitamin D is shown in Figure 15.

How Vitamin D Is Measured and Expressed. Biologically, vitamin D is determined by the use of rats. A biological unit (sometimes referred to as a Steenbock Unit) is the amount of the vitamin that will produce a certain amount of calcification in one of the bones of a standard test rat.

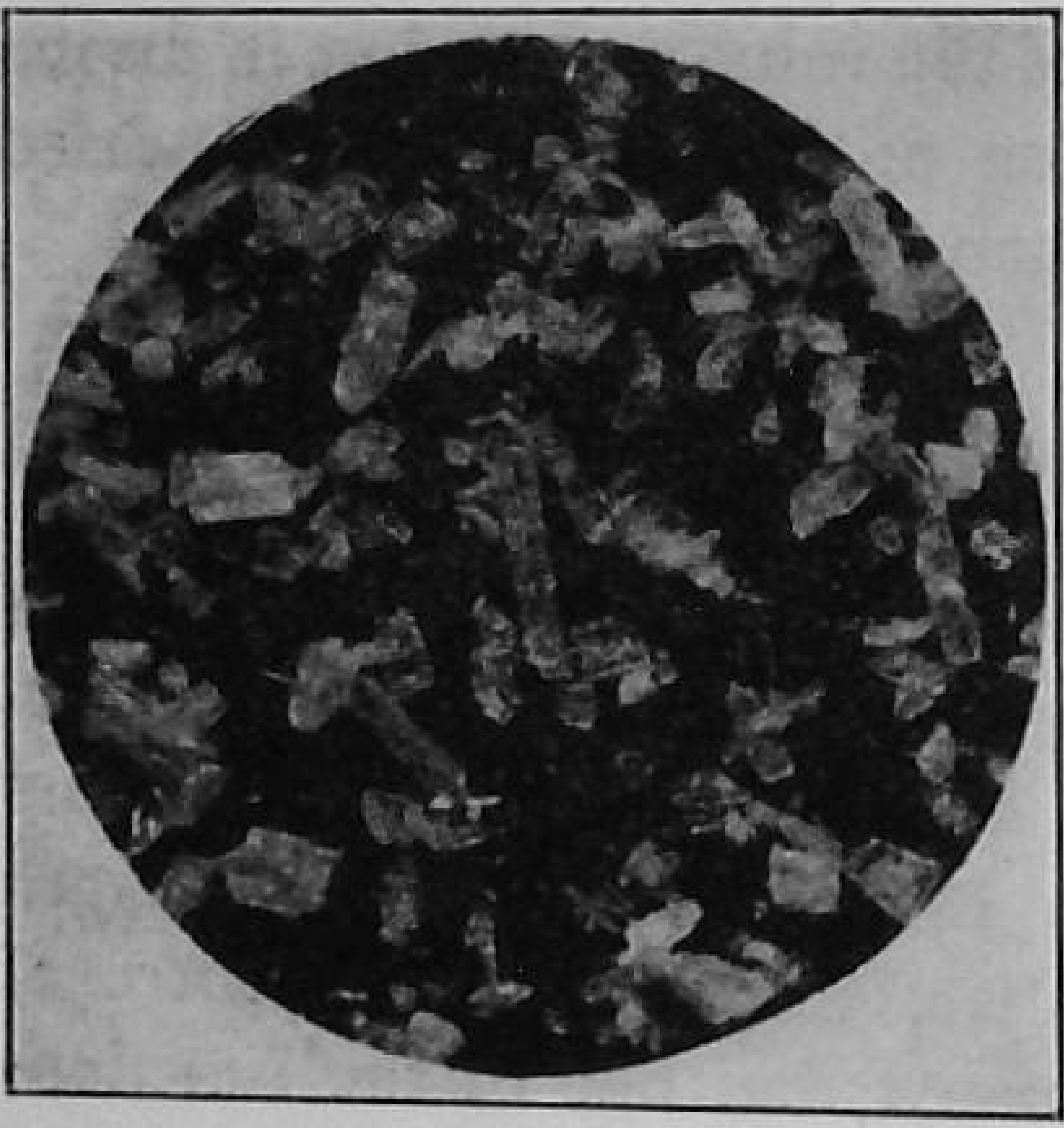

Fig. 15. Vitamin D. Courtesy, E. I. Squibb Company.

The International Unit of vitamin D is based on an International Standard of vitamin D which is a solution of irradiated ergosterol, 1 milligram of ergosterol activated by irradiation and dissolved in 10 cubic centimeters of olive oil. One International Unit is equivalent to 1 milligram of this solution, or 0.025 microgram of pure crystalline vitamin D. The United States Pharmacopoeia Unit is the same as the International Unit.

Vitamin D requirement and content of foods are expressed in terms of International Units. One International Unit is equivalent to 0.025 microgram of pure crystalline vitamin D. The Steenbock Unit is equivalent to 3.33 International Units.

Nutritional Significance of Vitamin D. Vitamin D assists nutrition by aiding in the absorption of calcium and phosphorus from the intestinal tract and their deposit as calcium phosphate in the body structures during growth. It is thus an important factor in the development of a good skeleton, jaws, and teeth and the later soundness of the teeth. In the absence of vitamin D during infancy and childhood, rickets develops. This vitamin is considered of importance to the adult as well, probably by

aiding him in the conservation of calcium and phosphorus in the body.

The first signs of a deficiency of vitamin D are an increase of calcium in the intestines and a decrease in the urine. An adequate amount of bile salt is necessary for the complete absorption of vitamin D.

The liver is the chief storehouse of vitamin D. There is also some present in the skin, lungs, and bones. The active vitamin D formed in the skin by irradiation is absorbed by the blood.

Requirements for Vitamin D. During the growing period the need for vitamin D is great. For younger children 400 to 800 International Units are recommended. Older children and adults no doubt need it in amounts at least equal to the minimum suggested for young children. It is thought that the usual diet and conditions under which the adult lives will supply him with adequate amounts of vitamin D but that with old age it might be desirable to see to it that the diet is fortified with the vitamin in some form. During pregnancy and lactation, the requirement is 400 to 800 International Units per day. See Table 9 for requirements and comments regarding vitamin D.

Sources. Fish-liver oils, particularly halibut, cod, and salmon, are the richest sources of vitamin D. Egg yolk is the richest food source of this vitamin in the ordinary diet. Milk, cream, and butter contain less, but when eaten in the amounts suggested on a good food standard, they may furnish considerable quantities. So-called vitamin D milk has had its normal vitamin D content enriched in one of several ways: the milk itself may have been irradiated, the milk may have come from cows that were fed a supplemental ration of irradiated ergosterol, or some rich concentrate of natural vitamin D may have been mixed with the milk.

Table 19 shows foods which supply vitamin D.

Vitamin D and Ultra-Violet Light. Certain plant foods contain the sterol (ergosterol) which is converted into vitamin D by irradiation with ultra-violet light. A similar substance with similar properties, 7-dehydro-cholesterol, is found in certain animal foods. Natural ultra-violet light from the rays of the sun or the artificial light from sun lamps is effective in converting these pro-vitamin D substances. The enrichment of food in vitamin D by irradiation is known as the Steenbock process, as

TABLE 19

SOURCES OF VITAMIN D *

	Excellent Sources	*Good Sources*	*Small Amounts*
Animal products	Fish-liver oils	Salmon	Liver
	Egg yolks (from hens on a diet high in vitamin D)	Sardines	Cream
		Eggs	Milk, whole
		Butter	Oysters
	Foods enriched with vitamin D by the Steenbock process of irradiation with ultra-violet light.		

* *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 288. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

the method was patented by Steenbock of the University of Wisconsin. Milk irradiated to increase its vitamin D content is the only food thus treated which is approved for acceptance by the Council on Foods of the American Medical Association.

Viosterol, which is now offered as a substitute for cod-liver oil, is irradiated ergosterol dissolved in an oil. It is more potent in vitamin D than cod-liver oil but does not contain any vitamin A, as cod-liver oil does.

Because a pro-vitamin D substance exists in the human body, an individual may secure vitamin D by exposing his body to ultra-violet light. The vitamin so formed is thought to act in the same way as the vitamin found naturally in food .

VITAMIN E

Discovery. A factor, other than vitamin A, necessary for normal reproduction, was discovered by Dr. Evans and his colleagues at the University of California and was called vitamin E. More than one hundred and thirty compounds have the activity attributed to this substance, the most active of which is a group of substances known as tocopherols. Vitamin E exists in three forms: *alpha, beta,* and *gamma* tocopherol, all three of which would seem to be present in all natural sources of the vitamin. *Alpha* tocopherol is the most active and has been produced in crystalline form.

Requirement. There is no doubt of the need for vitamin E by animals, but the human need has not yet been demonstrated

completely. Animals kept on a diet free of vitamin E show slow rate of growth, do not reproduce, and exhibit a characteristic muscular weakness or disorder. Any requirements that the human being may have are as yet unknown. The theory has been advanced that vitamin E may act as a respiratory enzyme in the living organism. In clinical practice, there is a small amount of evidence that vitamin E may be responsible for certain kinds of failures in reproduction in the female, but experimental evidence for this is lacking; also lacking is the evidence of the value of vitamin E in human muscular disorders.

Sources. Wheat-germ oil is the richest natural source of vitamin E. Cottonseed oil, lettuce oil, rice-germ oil, other vegetable oils, green leaves, and eggs contain considerable amounts. Vitamin E is so widely distributed in foods and the human requirement is possibly so slight, if it exists at all, that the ordinary well-selected diet may be considered to contain any amount that might be necessary for human beings.

Vitamin K

Discovery. In 1929 a Danish scientist by the name of Dam noted that chickens that were fed a certain artificial diet suffered severe hemorrhages. On examination, the blood of these chickens was found to require an unusually long time to clot. Certain foods were found to correct this condition. In 1935 a substance was isolated from these same foods and given the designation of vitamin K (from the Danish spelling of coagulation). It is sometimes called the anti-hemorrhagic factor. Two naturally occurring forms of this vitamin (one from alfalfa) have been isolated, and a synthetic form has been produced.

Nutritional Significance. The observation that the blood of certain patients with biliary diseases did not clot in the normal length of time and that this condition could be corrected with vitamin K has led to the conclusion that vitamin K has some human nutritional significance. The exact role that it plays is not known, although it is thought to be associated with the normal function of the liver and with the proper coagulation of the blood. It is apparently necessary in some way for the formation of prothrombin, which is one of the factors in normal blood clotting. A deficiency of vitamin K, which might be caused by

a deficient supply or poor absorption of this vitamin, results in a deficiency of prothrombin and consequent abnormal blood clotting.

Requirement. The exact minimum requirements of vitamin K have not yet been determined. It is assumed that, whatever the requirement, it is usually satisfied by a good diet. Newborn infants need special consideration in regard to vitamin K, as their blood is characteristically low in prothrombin content and clotting power. In medical practice, vitamin K is given either to the mother before the birth of the child or directly to the child immediately after its birth. The requirement of the infant has been set at 1 microgram.

Bile salts are necessary for the proper absorption of vitamin K from the intestine; its absorption may be prevented by liquid petrolatum if the latter is given near meal time. Larger amounts of vitamin K need to be taken in the food when there is inadequate absorption from the intestinal tract. A deficiency of vitamin K is measured by determining the amount of prothrombin in the blood.

Sources. Vitamin K is widely distributed, the richest sources being green leaves. Seeds, fruits, and roots have a smaller amount than the green leaves. The parts of the plant having chlorophyll usually contain the largest amounts of K.

Alfalfa and spinach are rich in vitamin K. Other good sources include cabbage, cauliflower, carrots and carrot tops, soybean oil, and seaweed. Tomatoes, orange peel, and hemp seed are fair sources.

QUESTIONS AND ACTIVITIES

1. What do you think of the statement, "Color is a good guide in selecting foods for their vitamin A value"?
2. Compare the vitamin A value of foods by determining the amount of vitamin A in 100-gram portions or average servings of some of the vitamin A foods listed in Table 18. Arrange these foods as an exhibit and discuss.
3. Explain how vitamin A is related to the eyes.
4. Set up an exhibit of vitamin A equivalents.
5. Weigh and display amounts of foods which furnish approximately one-tenth of an adult's daily requirement for vitamin A. Weigh these foods, display, determine, and record the amount of each in cups, tablespoons, or the number and size of pieces. Which are the best

sources of vitamin A? Does your diet furnish sufficient amounts of vitamin A? Estimate for each of the above foods the part of the average serving it represents and the approximate amount of vitamin A in the average serving.

6. Explain why vitamin D is thought to be of importance for adults as well as children.

7. What does the following mean on a bottle of cod-liver oil: contains 85 U. S. Units of vitamin D?

8. What foods on your three days' diet record, Activity 4, Chapter I, furnished vitamin D? Did you have any additional vitamin D in any form? Would you consider that you receive adequate vitamin D as a general rule?

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CHAPTER VI

VITAMIN REQUIREMENTS FOR REGULATION AND PROTECTION (*Continued*)

ASCORBIC ACID AND B COMPLEX VITAMINS

Ascorbic Acid (Vitamin C)

Discovery. It is difficult to determine just when scurvy, which is due to lack of a substance now known as vitamin C, was first experienced and described. Hippocrates is credited with first writing about some disease symptoms now recognized as those of scurvy. The Crusaders are reported to have suffered a similar affliction. During the latter part of the fourteenth and early fifteenth centuries scurvy was prevalent throughout Europe.

Historical accounts of early voyages of exploration as well as of wars from the time of Caesar to World War I carry, along with a record of military exploits, mention of the occurrence of scurvy and the loss of men as a result of the disease. The same accounts often tell also of attempts to cure it by feeding the victims certain substances, sometimes foods and sometimes other things.

As early as the middle of the sixteenth century Jacques Cartier learned from the Indians in Newfoundland of the curative effects of a tea made from the bark and leaves of a tree now known as a variety of the American spruce. In the seventeenth century lemon juice is reported to have saved the crew of a British ship on its way to India. Captain Cook in the late 1700's saved his men from scurvy on his globe-encircling trips by serving them daily drinks of freshly prepared sprouted barley.

In the middle of the 1700's a British navy surgeon, Dr. Lind, made the first attempt at a human feeding experiment on scurvy when he gave to several of his patients who were ill with scurvy

the few oranges and lemons available and to the other patients such things as cider, cream of tartar, or vinegar. The patients receiving lemon juice recovered and led to Dr. Lind's recommendation that some lemon or orange juice mixture be carried by all British sailors. This recommendation later became a requirement, so that the British sailors from that time received their daily allowance of some citrus juice, frequently of limes, and subsequently became known as limeys.

The first experimental production of scurvy in animals was not accomplished until 1907 when two Norwegian investigators, Holst and Fröhlich, produced the disease in guinea pigs and cured it with certain foods. Attempts to isolate the effective substance from foods finally led to the preparation in 1932 by C. G. King, of the University of Pittsburgh, of the substance, in crystalline form, which is now known as ascorbic acid. This was actually the first of the vitamins for which the definite chemical formula was determined, although it had been previously given the third alphabetical designation. The synthetic form of the vitamin has been produced and is referred to as cevitamic acid.

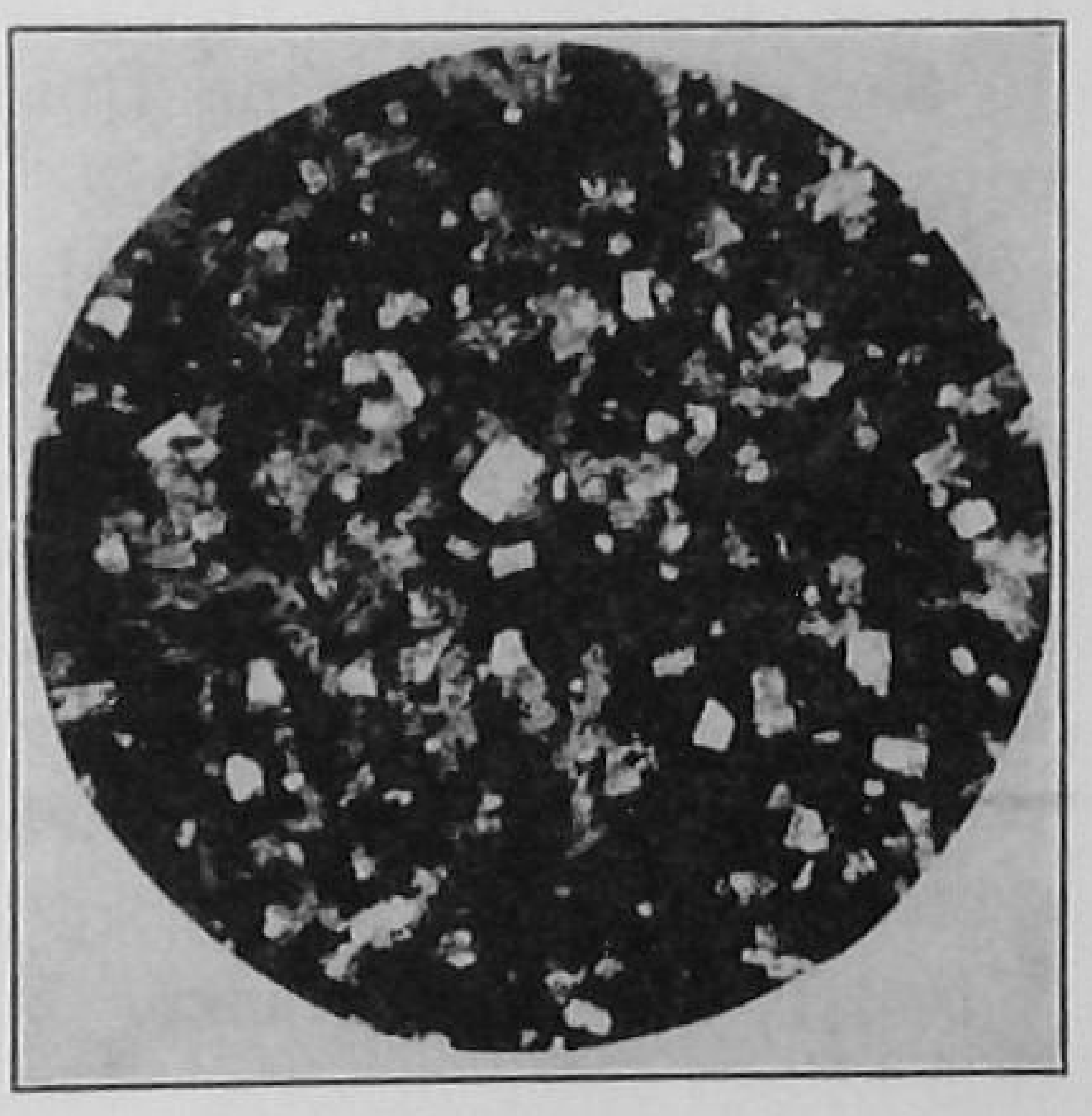

FIG. 16. Ascorbic acid crystals. Courtesy, Merck and Company, Inc., Rahway, New Jersey.

What Vitamin C Is. As stated above, vitamin C is ascorbic acid and, in synthetic form from the drug store, is known as cevitamic acid or ascorbic acid. It is sometimes spoken of as an oxidizing-reducing agent which means that it can unite with either oxygen or hydrogen. Therefore, it may exist in two forms but more often in the reduced form in the body; it is kept this way by an enzyme. In the blood and urine it is usually present in oxidized form since there is no enzyme to keep it otherwise; this form is not active nor can it be changed back. In plants, the form is easily oxidized and cannot be changed back, so vitamin C is unstable and easily lost. Figure 16 shows crystals of vitamin C.

How Vitamin C Is Determined and Expressed. Guinea pigs are used for determining vitamin C biologically. Rats cannot be used for this determination because either they do not need vitamin C or they need it in such small quantities as to be unmeasurable. It is possible also that they may synthesize it in their bodies. A biological or Sherman Unit of vitamin C is the amount of vitamin C which will just prevent scurvy symptoms over a period of 70 to 90 days in a standard test on young guinea pigs.

An International Unit of vitamin C is equivalent to 0.05 milligram of ascorbic acid. One International Unit is equivalent to 10 Sherman Units. One United States Pharmacopoeia Unit equals 1 International Unit; 1 milligram of ascorbic acid is equivalent to 20 International Units.

The vitamin C requirement and content of foods are expressed in milligrams. To convert microgram figures for vitamin C into milligrams, move the decimal point three places to the left.

Chemical tests have been devised for determining vitamin C in foods. These are color tests and depend upon the reducing property of vitamin C that changes the color of the testing substance.

Nutritional Significance. Vitamin C plays its role in nutrition in two different ways. To understand one of these ways, it is necessary to review something about cells in the body. Normally, cells in certain tissues, such as the bone marrow, tooth dentin, various connective tissues, and walls of veins and capillaries, are surrounded by a stiff jelly-like, cement-like substance known as intercellular cement. When vitamin C is lacking in the diet, this cement-like substance becomes thin and watery. As a result, changes occur in the teeth and the gums around them, in the bones, in the joints, and in the blood capillaries, resulting in hemorrhages; even wounds are prevented from healing properly.

The demands for growth that are placed on the child during the growing period make the deficiency show up in certain abnormalities of the bones and teeth; so-called growing pains are thought to be caused by lack of vitamin C. Severe exercise and muscular work in adults may make evident the lack of vitamin C in the appearance of hemorrhages.

Vitamin C is also related to infections in some way. It is

thought to play a part in combating them because it seems to be necessary for the proper functioning of the blood-serum complement, a substance in the blood which acts against the invasion of harmful products.

Requirement for and Factors Affecting Vitamin C. Table 9, page 19, lists the recommended allowances for ascorbic acid at different ages. Vitamin C cannot be stored in the body so a daily intake of the recommended allowances is necessary for good health. While vitamin C is not stored in the true sense of the word, the tissues can be filled either to saturation or to less than saturation. Saturation of the tissues is considered desirable for the best level of health. Additional amounts of vitamins over the recommended allowance are required for severe muscular exercise, during infectious diseases, pregnancy and lactation, in older age, and for the healing of wounds.

Vitamin C nutritional status and the requirement of human beings are studied by means of the capillary resistance or fragility tests which tell something about the strength of the capillary walls, and by means of a study of the amount of vitamin C in the blood and in the urine. When the tissues are saturated with vitamin C, excessive amounts of C are eliminated; when they are unsaturated, large doses of vitamin C are daily retained until the tissues again become saturated. As a result of the use of some of these tests it is estimated that a large part of the population is not in as good a state of vitamin C nutrition as might be desirable.

Sources and Factors Affecting Content of Vitamin C. Vitamin C has been called the "vitamin of fresh foods." All fresh fruits and vegetables are good sources. Citrus fruits are usually thought of as the best sources because they may contain more vitamin C and also because they retain it better under adverse conditions because of their high acid value.

The amount of vitamin C that a food contains when it is produced depends on such factors as the soil, climate, and degree of ripeness; the amount food contains when it is being prepared for use depends on the conditions under which and the length of time it has been stored or dried, or, if frozen, on the blanching preliminary to freezing. The amount of the vitamin in the food after it has been cooked and is ready to be served depends upon the care in cooking. Vitamin C is very easily destroyed by oxida-

tion and it is also water soluble. Consequently, anything which increases its contact with oxygen will cause destruction. Preparing foods ahead of time and allowing them to stand is not good for vitamin C. Soaking foods causes further loss, especially

TABLE 20

FOOD SOURCES OF ASCORBIC ACID *

	Excellent Sources		Good Sources	
Animal products	Liver	Brain	Kidney	
Vegetables	Collards	Turnips	Endive	
	Turnip greens	Brussels sprouts	Cucumbers	
	Mustard greens	Cauliflower	Potatoes, white	
	Kale	Cabbage	Potatoes, sweet	
	Water cress	Broccoli	Beans, green	
	Spinach	Asparagus	Parsnips	
	Dandelion greens	Tomatoes, fresh and canned	Rhubarb	
	Peppers, sweet		Leeks	
	Kohlrabi	Peas, green	Onions	
	Rutabagas	Corn salad	Artichokes, globe	
Fruits	Guavas	Currants	Pineapple	Apples
	Mangoes	Raspberries	Cherries	Avocados
	Oranges	Strawberries	Cranberries	Watermelon
	Lemons	Gooseberries	Papayas	
	Grapefruit	Cantaloupe	Bananas	
	Tangerines		Peaches	
Seeds	Seeds, sprouted			

* *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 289. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

if the soaking water is destroyed. During the cooking process, much of the vitamin may be lost in the cooking water. Allowing foods to stand after cooking or reheating also adds to the destruction.

It is interesting to note that resting seeds have little if any vitamin C. When they are allowed to sprout, however, they become sources of the vitamin.

Table 20 indicates sources of ascorbic acid. Figure 17 compares this ascorbic acid content of foods.

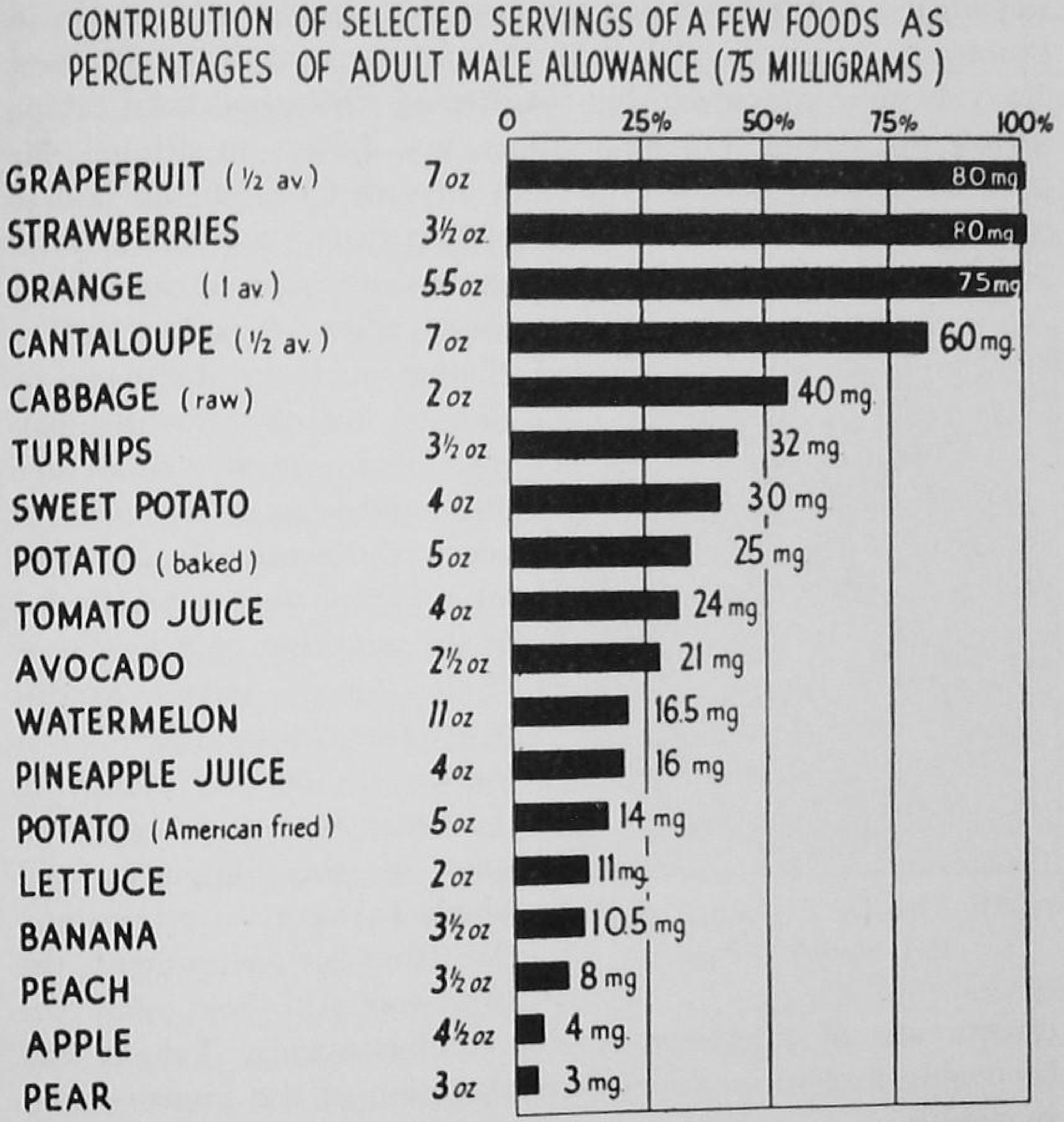

FIG. 17. Foods as sources of ascorbic acid (vitamin C). In addition to citrus fruits and tomatoes many common fruits and vegetables supply significant amounts of ascorbic acid, especially if eaten raw. This vitamin is readily destroyed by heat, and it is extracted by water. Food Charts, 1942. Courtesy, American Medical Association.

THIAMIN(E) (VITAMIN B_1)

Discovery. Beriberi, which affects the nerves, is a disease that was recognized in the Orient for so many years that even the origin of the name is uncertain. It has occurred and still does in groups or in individuals who exist principally on a diet of polished rice that has been so refined in the milling process that the outer coat of the seed containing the vitamins is removed.

Although this disease was described as early as 2600 B.C., it was

not until A.D. 1885 that diet was assumed to play any role in its causation. At this time, Takaki, Director General of the Japanese Navy, became convinced that the disease, which had been taking such a toll among Japanese sailors, was dietary in origin. He (like Dr. Lind experimenting with vitamin C) might be said to have performed the first human feeding experiment on vitamin B; it was, in fact, the first human feeding experiment of any kind when Takaki had a change made in the navy ration to include one-third barley, some meat, condensed milk, and vegetables. Cases of beriberi subsequently decreased on this new ration which led to the adoption of a new type of diet for the navy. At this time the improvement was thought to be due chiefly to the better type of protein. In spite of this discovery, for which Takaki received recognition from his government, the view was still held that the disease was of infectious origin. Unfortunately, Takaki had been able to give no scientific explanation of the improvement in health.

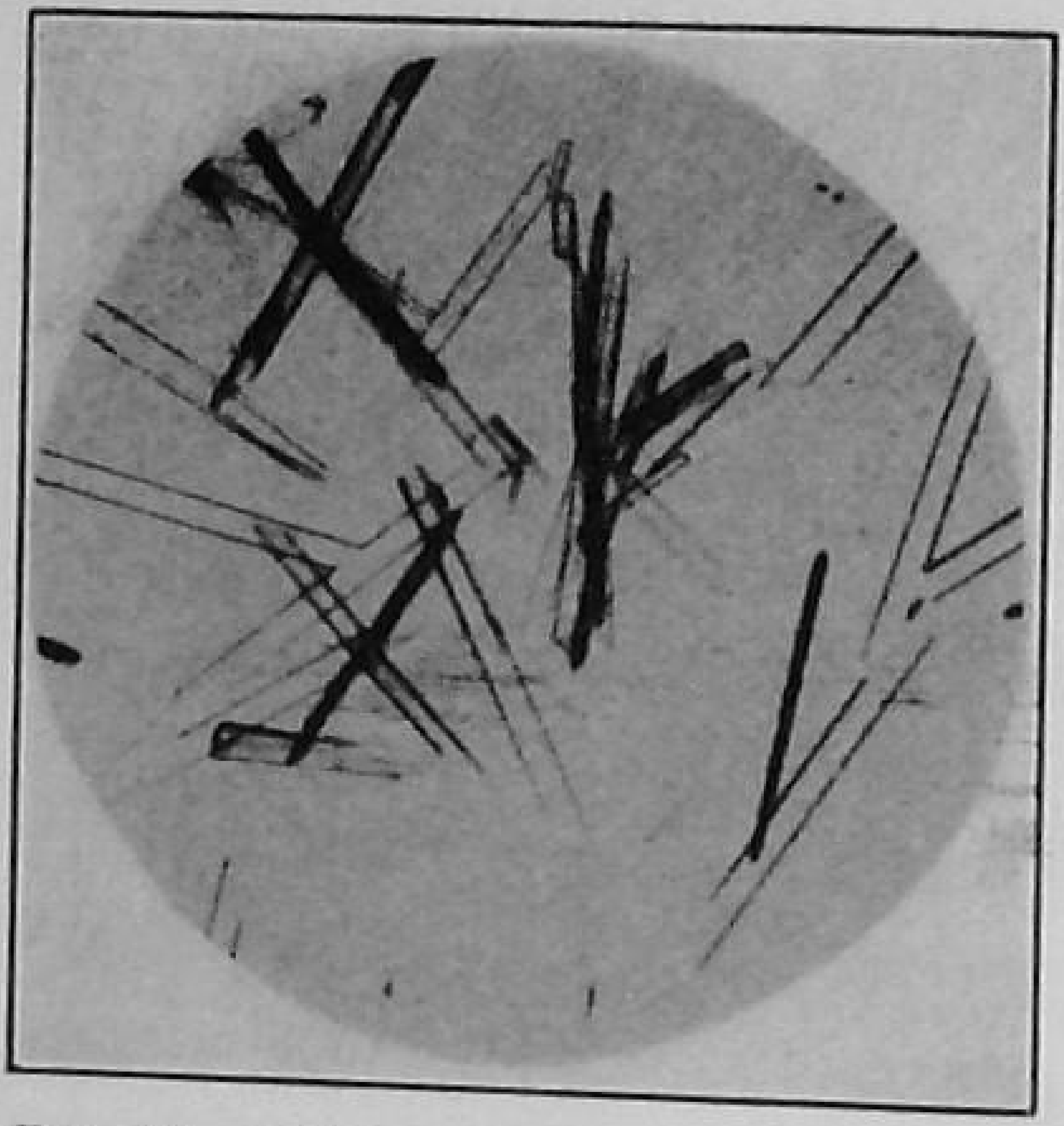

FIG. 18. Thiamin crystals. Courtesy, E. I. Squibb Company.

Beriberi was first produced experimentally in 1897 in the East Indies by a Dutch physician, Eijkman. He noticed that fowls which ate leftover polished rice from prison fare developed a disease similar to human beriberi and could be cured with rice polishings. He thus discovered the first vitamin (even though it was to be labeled with the second alphabet letter) and produced experimentally the first dietary deficiency.

Since this time, the relation between the nerve disorder and vitamin B_1 has been demonstrated repeatedly. In 1926 a crystalline product was isolated from rice polishings by Janzen and Donath. Ten years later, R. R. Williams, an American chemist, discovered the chemical nature of the vitamin and synthesized it. The official name for this substance is thiamin. Aneurin is sometimes used in place of thiamin in English literature. Thia-

min is now available in pure crystalline form. Figure 18 illustrates thiamin crystals.

What Vitamin B_1 Is. The crystalline vitamin B_1 is called thiamin, thiamin chloride, or thiamin chloride hydrochloride (aneurin in Europe). This vitamin is water soluble and is destroyed by heat in the presence of moisture, the rate depending upon the alkalinity or acidity (the vitamin is more stable in acid). It is still called vitamin B popularly, although it is only one of the substances present in what was formerly known as vitamin B. The old vitamin B is now generally referred to as the vitamin B complex since it has been found to be made up of at least a dozen factors, nine of which have been obtained in crystalline form.

How Thiamin Is Measured and Expressed. Rats are used for the biological measurement of vitamin B_1. A biological or Sherman Unit is the amount of the vitamin which will allow a 3-gram gain in weight per week during a test period of four to eight weeks in a standard test rat.

An International Unit is equivalent to 3 micrograms (.003 mg.) of thiamin chloride. One International Unit equals 2 Sherman Units. One International Unit equals 1 United States Pharmacopoeia Unit.

The requirement for and the content of thiamin in foods are expressed in milligrams. To convert microgram figures to milligrams, move the decimal point three places to the left.

Nutritional Significance. Thiamin has long been known to be essential for the promotion of growth and the prevention of polyneuritis. It is popularly known as the appetite vitamin since it is related to the appetite. However, it is not correct to assume the effect of vitamin B_1 on anything other than a poor appetite. It does not increase an otherwise good appetite. Vitamin B_1 also plays an important role in the proper functioning of the alimentary tract, thereby assisting both the digestion and absorption of food.

A very important and more recently recognized role is its relation to the proper metabolism and use of carbohydrates. During the conversion of the carbohydrates into water and carbon dioxide and the accompanying production of energy, a substance known as pyruvic acid is formed. When the diet contains a sufficient amount of thiamin, the pyruvic acid is taken care of prop-

erly and converted completely to carbon dioxide and water. Thiamin takes care of this in its combined form with phosphoric acid (as a coenzyme called cocarboxylase). In the absence of thiamin in the diet, the pyruvic acid accumulates in various parts of the body and is responsible for most of the characteristics associated with a deficiency of vitamin B_1. In this respect, thiamin is extremely important to the proper functioning of the active types of cells in all the bodily systems. It is also because of this that vitamin B_1 is able to perform the widely unrelated functions in the body which are ascribed to it.

Requirements for and Factors Affecting Thiamin. Fairly small amounts of thiamin, if any, can be stored by the body. Therefore, the daily diet must supply adequate amounts. The fact mentioned previously, that thiamin is necessary for the metabolism of the energy food, carbohydrates, makes the quantity of thiamin required more or less dependent upon the amount of energy the individual expends. The quantity of thiamin is, therefore, proportional to the number of non-fat calories rather than the total calories. The fat content of the diet has a sparing effect on thiamin. In general, the more carbohydrate eaten, the more thiamin needed; the more energy spent, the more thiamin needed.

The amount of thiamin required is increased whenever the rate of metabolism is increased, as in the case of fevers or an overactive thyroid gland, or when large amounts of water are excreted, since thiamin is water soluble. Larger amounts than the usual ones suggested for the adult are also needed during pregnancy and lactation. Recommended daily allowances for thiamin are given in Table 9, page 19.

Sources. Thiamin is quite widely distributed in nature but there are few really rich food sources. This fact, plus the fact that some of the good natural sources, such as the whole grains, have been relieved of so much of their thiamin content in the refining process, probably accounts for the rather common national dietary deficiency of vitamin B_1. In addition to the whole-grain or whole-wheat bread available for many years, of which the American public has never become too fond, the white bread now made from enriched flours (flours which have been fortified with thiamin, iron, and niacin) offers a means of reinforcing the diet in thiamin.

Nutrition authorities tell us that, with one-half of the total calories needed coming from the protective foods and one-half of the recommended allowances of cereals in the daily diet from the whole-grain varieties, the thiamin content is insured. Table

TABLE 21

FOOD SOURCES OF THIAMIN *

	Excellent Sources		*Good Sources*		*Fair Sources*
Animal products	Pork, lean		Egg yolk	Fish roe	Milk, fresh (whole or skim)
	Chicken		Brains	Codfish	
	Kidney		Beef, lean	Sardines	
	Liver		Mutton, lean	Whiting	
Vegetables	Peas, green		Potatoes	Lettuce	Turnips
	Beans, Lima, green		Sweet corn	Collards	Broccoli
			Sweet potatoes	Kale	Kohlrabi
			Brussels sprouts	Onions	Eggplant
			Cauliflower	Leeks	
			Cabbage	Tomatoes	
			Mushrooms	Wax beans	
			Spinach	Green beans	
			Water cress	Beets	
			Turnip greens	Carrots	
			Garden cress	Parsnips	
Fruits			Prunes	Dates	Bananas
			Avocados	Figs	Watermelon
			Pineapple	Plums	Raspberries
			Oranges	Pears	Blackberries
			Grapefruit	Apples	
			Tangerines	Cantaloupe	
Seeds	Wheat germ	Rye	Hazelnuts		
	Corn germ	Barley	Chestnuts		
	Rye germ	Brown rice	Brazil nuts		
	Rice polishings	Peanuts	Walnuts		
	Wheat bran	Soybeans	Almonds		
	Oats	Cowpeas	Pecans		
	Wheat, whole-grain	Navy beans			
		Dried peas			

* *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 290. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

21 shows good sources of vitamin B_1 (thiamin). Figure 19 compares the thiamin content in several foods.

Effect of Heat, Acids, Alkalis, Etc. Vitamin B_1 is water soluble and not too stable when heated, especially if subjected to higher temperatures for a long period of time. Much vitamin

B_1 may be lost if the cooking water is not utilized and if the food is cooked at too high a temperature and for too long a time. Blanching foods previous to canning or freezing causes some

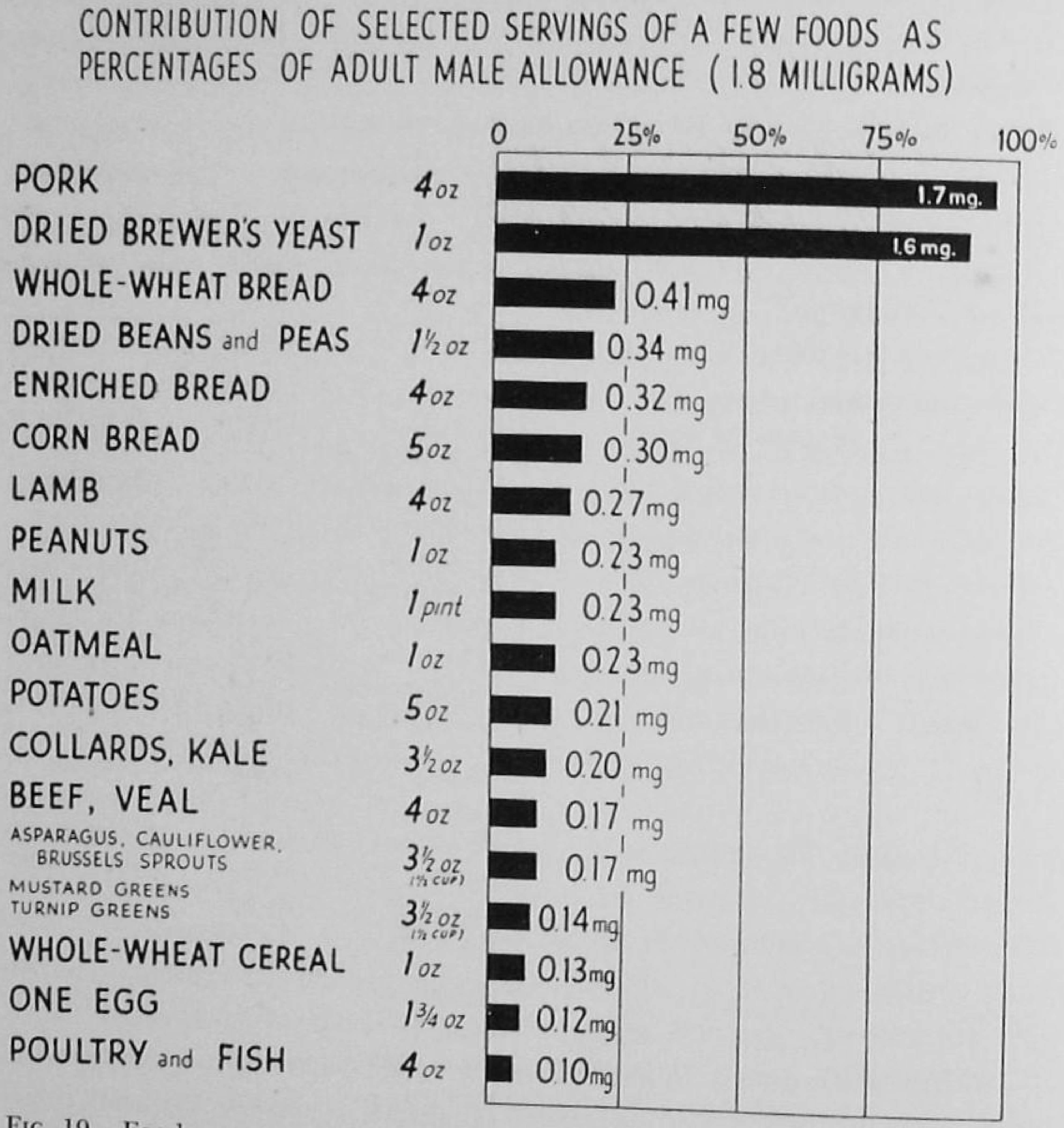

FIG. 19. Foods as sources of thiamin (vitamin B_1). Except for pork, common foods supply only small amounts of thiamin, the best sources being nutritionally unimpaired cereals and meats; some thiamin may be lost in cooking, either through destruction by heat or extraction by water. Food Charts, 1942. Courtesy, American Medical Association.

destruction of thiamin, but the processing, which is part of the canning process, and the freezing process itself cause no further loss. Some loss of vitamin B_1 occurs during baking and considerable amounts during roasting. Quicker cooking methods are to be preferred to such longer methods as oven cookery where vitamin B is concerned.

Riboflavin (Vitamin G)

Discovery. When the vitamin now known as thiamin was first recognized, it was called simply vitamin B and was credited with anti-neuritic properties. Soon it appeared that different sources of this newly discovered vitamin acted differently. Also, after heating, some of the foods would no longer cure beriberi or polyneuritis, but they would still promote growth in animals. This portion not destroyed by heat proved to be a new substance different from the anti-neuritic one. Vitamin B was therefore shown to be actually two substances instead of one: B_1 or the anti-neuritic portion, later to be called thiamin, and B_2 or vitamin G.

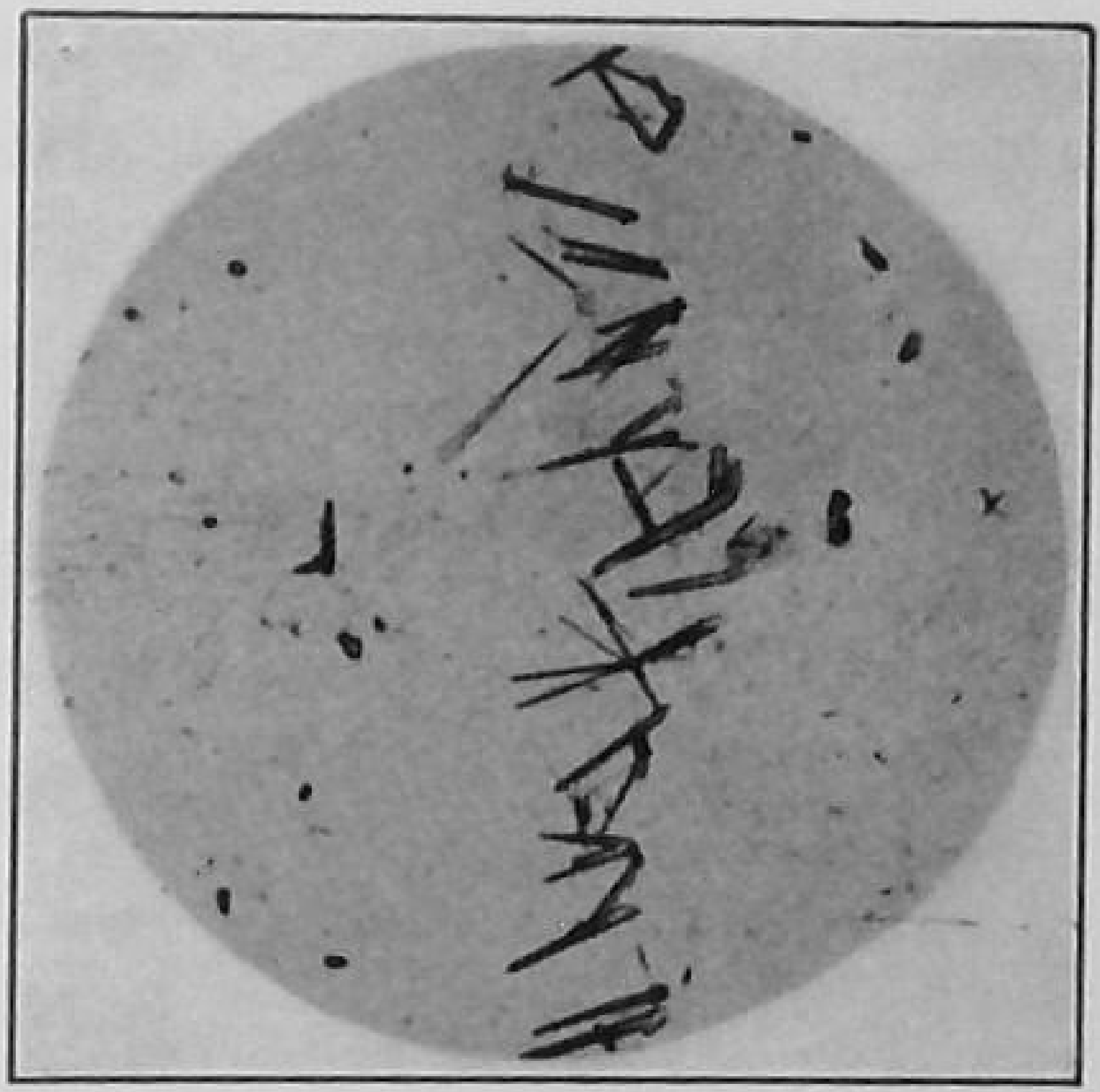

Fig. 20. Crystalline riboflavin. Courtesy, E. I. Squibb Company.

As more was learned regarding this vitamin G, and especially that it was yellow pigmented and belonged to a group of substances known as flavins, it was given the name of riboflavin. Earlier, it had been called lactoflavin since it was first isolated from milk, but the term riboflavin indicates this water-soluble vitamin regardless of its source. Riboflavin was first synthesized in 1935.

What Riboflavin Is. Riboflavin, like carotene, is a pigment and includes either the flavin (from flavus, meaning yellow) from milk, lactoflavin, ovoflavin from eggs, or hepatoflavin from liver. Crystalline riboflavin is shown in Figure 20.

How Riboflavin Is Measured and Expressed. Rats are used to determine riboflavin biologically. A biological unit or a Sherman-Bourquin Unit is the amount that will allow a weekly 3-gram gain in weight over a period of four weeks in a standard test rat.

No International Unit has been established for riboflavin. One Sherman-Bourquin Unit is about 2.5 to 3 micrograms of riboflavin. One gram of purified or synthesized G contains 500,000 Sherman-Bourquin Units.

Nutritional Significance. Riboflavin is, in some way, important for a certain body enzyme which assists in energy metabolism in the body. An indication that riboflavin must be considered important in life processes is the fact that it is found in large amounts in active organs in the body as well as in the green leaves and green parts of the plant. A riboflavin deficiency affects both the skin and the eye. A peculiar cracking

TABLE 22

FOOD SOURCES OF RIBOFLAVIN *

	Excellent Sources	*Good Sources*	*Fair Sources*	
Animal products	Liver	Milk, fresh (whole or skim)		
	Kidney	Buttermilk		
	Heart	Whey		
	Muscle meat, lean			
	Eggs			
	Cheese			
	Milk, dried (whole or skim)			
	Milk, condensed			
	Milk, evaporated			
Vegetables	Turnip tops	Peas		
	Beet tops	Lima beans		
	Kale	Spinach		
	Mustard greens	Water cress		
		Collards		
		Endive		
		Broccoli		
		Lettuce, green		
		Cabbage		
		Cauliflower		
		Carrots		
Fruits		Pears	Bananas	Guavas
		Avocados	Figs, cured	Papayas
		Prunes	Grapefruit	Muskmelons
		Mangoes	Oranges	Apples
		Peaches	Apricots	
Seeds	Wheat, germ portion	Wheat, whole-grain		
	Rice polishings	Dried legumes		
	Peanuts			
	Soybeans			

* *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 290. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

of the skin at the corners of the mouth, referred to as cheilosis, was the first riboflavin deficiency recognized in humans. This deficiency may occur alone or in connection with pellagra. Ribo-

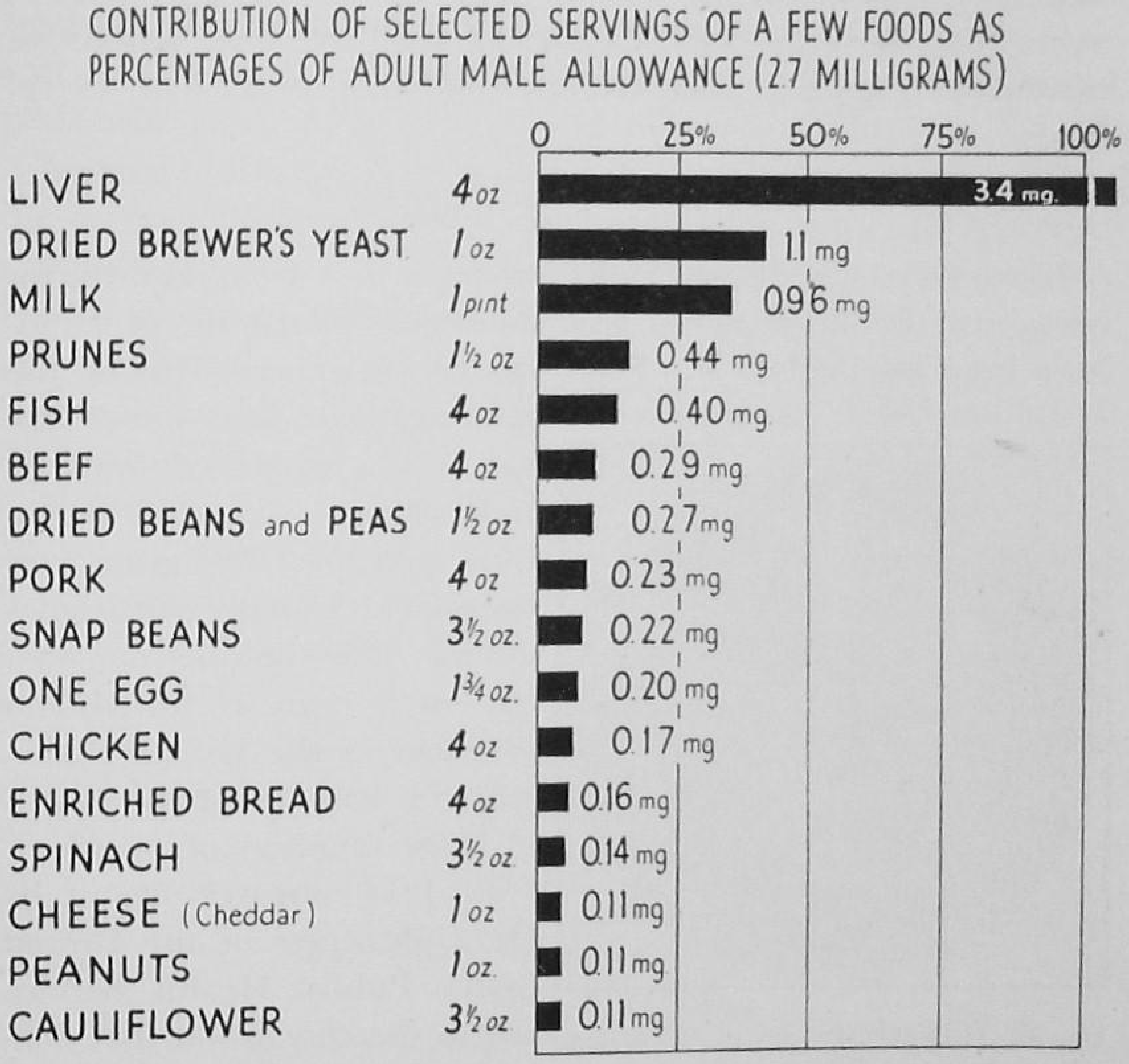

FIG. 21. Foods as sources of riboflavin (vitamin G). Milk is the most important common source of riboflavin. This vitamin is not readily destroyed by heat, but it may be lost by extraction in water during cooking and by prolonged exposure to light. Food Charts, 1942. Courtesy, American Medical Association.

flavin appears to be essential to growth and good nutrition at all ages.

Requirement. Recommended daily allowances for riboflavin at various ages are given in Table 9, page 19. If a diet adequate in all other respects as to food nutrients is consumed, there is thought to be little danger of an inadequacy in vitamin G intake. Work in some laboratories indicates that much larger amounts of riboflavin than will merely protect from symptoms of riboflavin deficiencies will result in great gains in health.

Sources. Riboflavin is widely distributed in natural foods. Meats, eggs, milk, green leafy vegetables, whole grains, and legumes are very good sources. In general, glandular meats contain more than muscle meats, and the dark meats appear to have more than the light ones. Table 22 indicates food sources of riboflavin. Figure 21 compares the riboflavin contents of several foods.

Nicotinic Acid (Niacin)

Discovery. A disease called pellagra has been known for many years. Many causes, such as toxins, infections, or foods, have been ascribed to it. Food has always appeared to be the ranking cause and some time ago it was suggested that the lack of some vitamin might cause pellagra. Pellagra is now considered a vitamin-deficiency disease; it is the only one that has ever been a nutritional problem in the United States, where it has caused the deaths of large numbers of people.

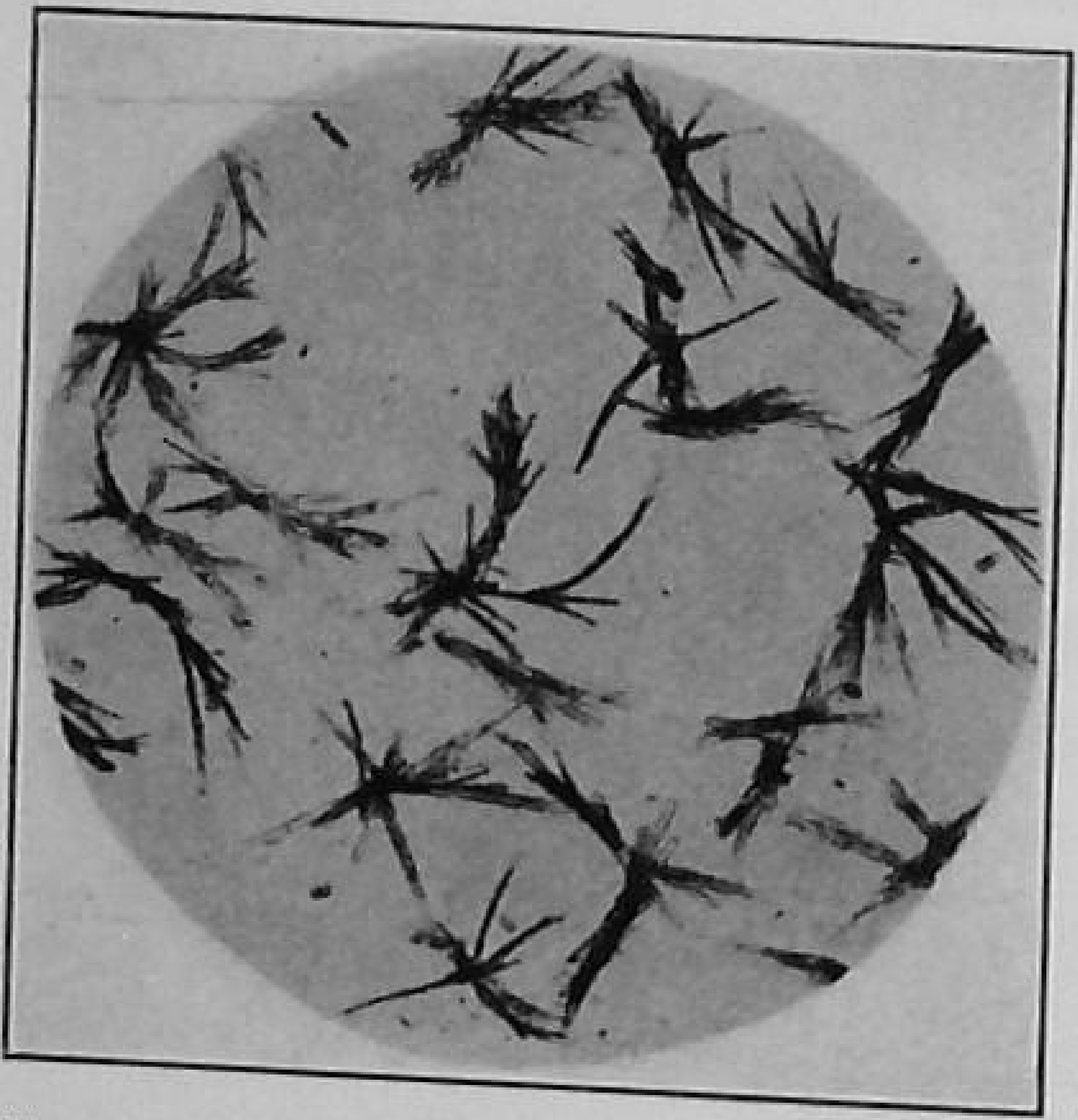

Fig. 22. Crystalline niacin. Courtesy, E. I. Squibb Company.

In 1914, research begun by Dr. Goldberger of the United States Public Health Service led to the conclusion that definite foods could cure and prevent the disease, and the food anti-pellagric factor was called the P-P or pellagra-preventive factor. Dogs that were kept on a diet similar to that producing pellagra developed a disease called black tongue. In treating dogs with this disease, Elvehjem, only as late as 1937, showed, at the University of Wisconsin, that nicotinic acid would cure and prevent it. Nicotinic acid, which was known as a drug for a long time, was then given to pellagrins and effected a cure. Nicotinic acid and the P-P factor were discovered to be identical.

What Nicotinic Acid Is. Since nicotinic acid was known as a chemical substance long before its anti-pellagric properties were discovered, it was not necessary to give it an alphabetical designation as has been done with the other vitamins. This vitamin,

previously called nicotinic acid or nicotinic amide, is now called niacin or niacin amide. Its crystalline form is shown in Figure 22.

How Niacin Is Measured and Expressed. The niacin content of foods is measured directly, and the requirement and content in foods are expressed in milligrams of the pure chemical substance.

Nutritional Significance. Niacin is a necessary substance for the formation of compounds that act as coenzymes and function in oxidation-reduction reactions, being necessary for respiration. Niacin performs these functions in combination with thiamin and riboflavin.

Requirement. Recommended allowances for niacin are listed in Table 9, page 19.

Sources. Best sources of niacin are liver, yeast, lean meats, and eggs. Green leaves are the richest vegetable sources. Peas, beans, and tomatoes are good. Table 23 lists food sources of niacin (nicotinic acid). Figure 23 compares foods as sources of niacin.

Properties. Niacin is stable and there is little loss during the cooking process unless the cooking water is discarded.

TABLE 23

FOOD SOURCES OF NICOTINIC ACID *

	Good to Fair Sources		
Animal products	Liver	Beef, corned	Egg yolk
	Salmon	Pork, lean	Milk, skim (fresh) and dried
	Rabbit	Chicken	Milk, evaporated
	Beef, fresh	Buttermilk	Haddock
Vegetables	Peas, green	Turnip greens	Spinach
	Collards	Cowpeas	Mustard greens
	Kale	Soybeans	
	Tomato juice	Cabbage, green	
Seeds	Wheat germ	Peanut meal	Peas, green, dried

Foods most effective for curing pellagra in human beings include lean meat, chicken, liver, green leafy vegetables, legumes, and tomato juice.

* *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 291. Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

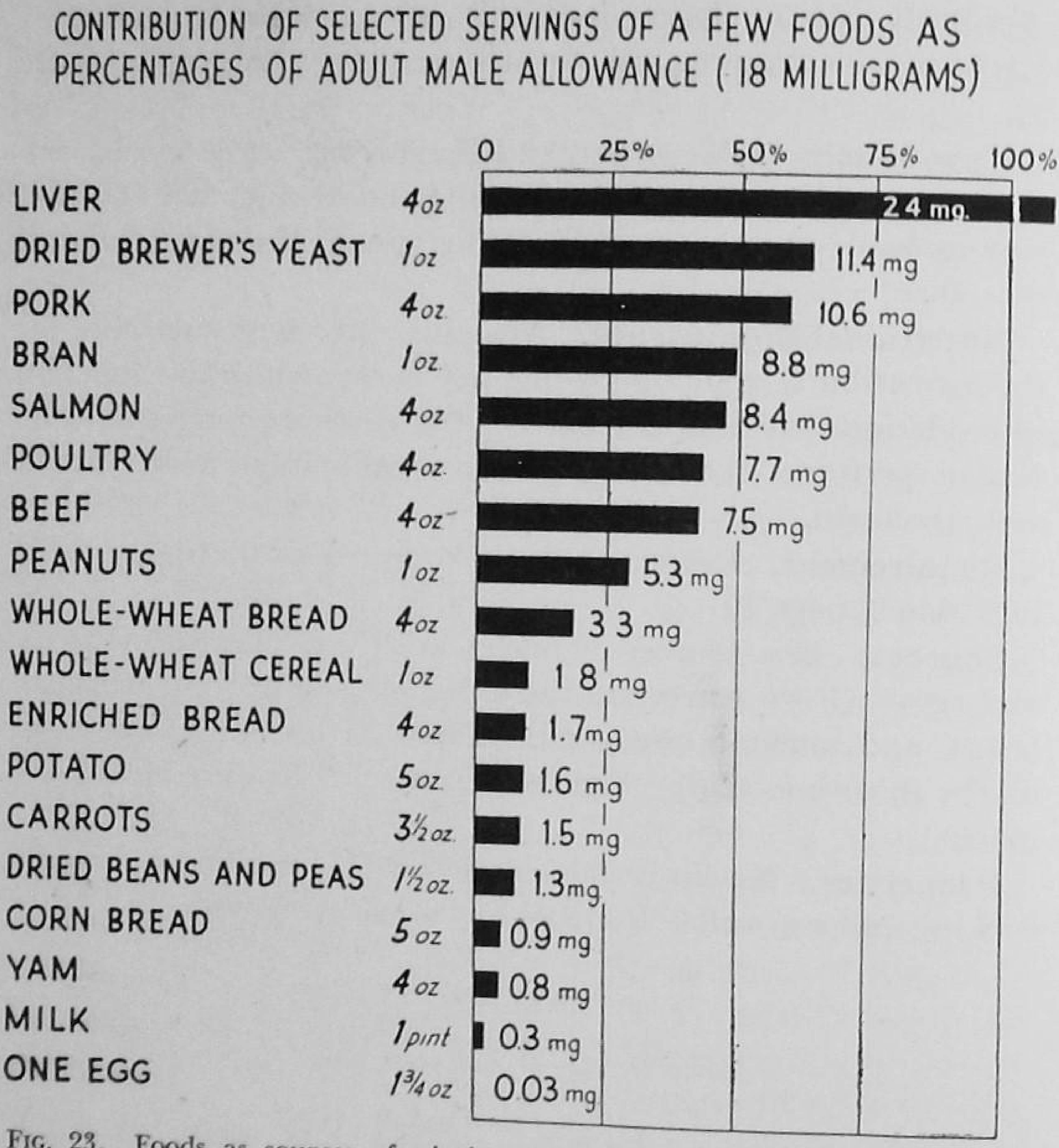

FIG. 23. Foods as sources of niacin (nicotinic acid). Meats are the most important common source of this vitamin. Food Charts, 1942. Courtesy, American Medical Association.

OTHER VITAMINS

B Complex Vitamins. The term B complex is used to cover all the vitamins that have been separated and differentiated from the substance originally thought of as vitamin B. Some dozen parts have thus been recognized, of which thiamin, riboflavin, and niacin have already been discussed. Others include the following.

Pyridoxine or Vitamin B_6. This vitamin seems to be related to the enzyme systems of the body, possibly to the unsaturated fatty acids, and may have something to do with the synthe-

sis of fat from protein. In human beings there has been demonstrated no clear-cut B_6 deficiency, but pellagrins who are receiving sufficient thiamin, riboflavin, and niacin may show further improvement when given the additional vitamin B_6. The exact human requirement has not been determined, but it is thought to be about 2 milligrams per day. Food sources include vegetable oils, seeds, egg yolk, yeast, liver, cereals, fresh vegetables, and milk. Vitamin B_6 is available in synthetic form.

Pantothenic Acid. There is much evidence to show that animals need pantothenic acid, but little is known regarding its significance in human nutrition. No specific deficiency symptoms have been demonstrated in human beings, but it is thought to be related in its action to riboflavin and pyridoxine. It occurs in all living cells and is so widely distributed that even very restricted diets may not be low enough in this substance to result in a serious deficiency. No figures have been established for human requirements, but they are thought to be higher than for any of the other B vitamins, possibly as much as 5 milligrams per day.

Liver is one of the richest natural sources, one serving furnishing about the estimated daily supply. Other good sources are cereals, milk, and meats. Pantothenic acid is water soluble and not too stable to heat, especially high temperatures, but is more stable in moist than prolonged dry heat. Whole wheat is also a good source, but about half the content is removed in the milling process. Pantothenic acid was synthesized in 1940.

Choline. This vitamin is proving to be an important member of the B complex and plays some role in fat metabolism by preventing the accumulation of fat in the liver. It is a component part of lecithin, which is thought to be an important factor in the metabolism of fat. Choline is more stable in an acid medium than in alkaline, even at high temperatures, and is found in eggs, cereals, and meats.

Para-Amino Benzoic Acid. Some evidence exists to indicate that this vitamin may play some part in the prevention of gray hair. Evidence of this kind is fairly well established for animals, less well for human beings. It is found in liver, yeast, and rice polishings.

Biotin. Biotin is the vitamin originally referred to as vitamin H. It is stable to heat and is found in liver, yeast, egg yolk,

and kidney. More work is necessary before its exact human functions and requirements can be definitely stated.

Inositol. The function of this substance in human nutrition is still a matter to be settled. It is found in the thyroid, brain, kidney, heart, and spleen, and in plants, cereal brans, and seeds. In plants it is thought to exist as phytin, a calcium magnesium salt of inositol phosphoric acid.

Requirements for These B Complex Vitamins. It is thought that dietaries which supply adequate amounts of thiamin, riboflavin, and niacin will also supply adequate amounts of any of these B complex vitamins since they occur, in general, in the better sources of the three vitamins named first.

Citrin-Vitamin P. Some nutrition investigators consider citrin to be necessary in addition to ascorbic acid for the best condition of health of the walls of the blood vessels. Since it is thought to specifically affect the permeability of the walls (in its absence, the walls become porous) it is designated as vitamin P. It was first extracted from paprika. It is also present in citrus fruits and the peel of lemon. It apparently has some function in preventing hemorrhages but in a different way from vitamin K.

QUESTIONS AND ACTIVITIES

1. Compare the ascorbic acid content of foods by determining the number of milligrams of ascorbic acid in 100-gram portions or average servings of some of the ascorbic acid-rich foods listed in Table 20. Arrange these foods as an exhibit and discuss.
2. Arrange an exhibit of ascorbic acid equivalents.
3. Weigh and display amounts of foods which furnish one-tenth of the adult daily requirement for ascorbic acid. Weigh these foods, display, determine, and record the measure in cups, tablespoons, or the number and size of pieces. Which are the best sources of ascorbic acid? Is your diet adequate in vitamin C? Estimate for each of the above foods the part of the average serving it represents and the approximate amount of vitamin C in the average serving.
4. Arrange as an exhibit to show the number of glasses of pineapple, tomato, cranberry, sauerkraut, grapefruit, and apple juice equivalent to one glass of orange juice in vitamin C value.
5. Compare the thiamin content of foods by determining the number of milligrams of thiamin in 100-gram portions or average servings

of some of the thiamin-rich foods listed on Table 21. Arrange these foods as an exhibit and discuss.

6. Arrange an exhibit of thiamin equivalents.

7. How do whole-wheat bread, enriched bread, and ordinary white bread compare in thiamin content?

8. Weigh and display amounts of foods which furnish approximately one-tenth of the adult daily requirement for thiamin. Weigh these foods, display, determine, and record the measure in cups, tablespoons, or the number and size of pieces. Which are the best sources of thiamin? Is your diet adequate in thiamin? Estimate for each of the above foods the part of the average serving it represents and the approximate amount of vitamin B in the average serving.

9. Compare the riboflavin content of foods by determining the number of milligrams of riboflavin in 100-gram portions or average servings of some of the riboflavin-rich foods listed in Table 22. Arrange these foods as an exhibit and discuss.

10. Arrange an exhibit of riboflavin equivalents.

11. Weigh and display amounts of foods which furnish approximately one-tenth of the adult daily requirement for riboflavin. Weigh these foods, display, determine and record the measure in cups, tablespoons, or the number and size of pieces. Which are the best sources of riboflavin? Is your diet adequate in riboflavin? Estimate for each of the above foods the part of the average serving it represents and the approximate amount of riboflavin in the average serving.

12. Write a short essay on the importance of vitamins for good health.

13. What foods eaten daily by you and your family furnish vitamins A and D and thiamin, riboflavin, ascorbic acid, and niacin? What suggestions can you make for increasing the vitamin content of your family's diet?

14. Formulate general rules to follow in choosing one's food to insure an adequate supply of vitamins.

15. Which of the considerations listed in Activity 14 in Chapter IV, regarding the conservation of minerals, apply also to the retention of vitamins? What additional considerations are of importance in food preparation in order to insure the maximum retention of vitamins?

16. Compare the cost of one-half of the adult daily requirements for vitamin A, thiamin, riboflavin, and ascorbic acid when secured from one or several good food sources and from one of several widely advertised and widely sold drugstore vitamin concentrates. Ask local druggists the names of vitamin A, thiamin, riboflavin, ascorbic acid, and vitamin D concentrates most frequently asked for.

17. What foods available in your community are the most economical sources of each of the several vitamins?

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CHAPTER VII

HOW THE BODY USES FOOD: DIGESTION AND METABOLISM

Steps in the Use of Food by the Body. Food materials, as eaten, are complex and generally in insoluble form. They cannot be utilized by the body until changed to simpler forms that are soluble in water so they can be absorbed into the blood.

Digestion is the process by which complex food substances are made ready for absorption. It starts in the stomach and ends in the small intestine. Absorption refers to the passage of these digested food substances through the intestinal wall into the blood, either directly or indirectly. Metabolism represents all the chemical changes which the products from digestion undergo from the time they are absorbed until they have been utilized in one way or another.

What Digestion Does. Digestive processes make foods soluble in water, change the complex starches and sugars into simple sugars, and change fats to fatty acids and glycerol, and proteins into their constituent amino acids.

The Digestive Apparatus. The parts of the body that are concerned with digestion include the mouth, stomach, intestines (which make up the alimentary or digestive tract—a continuous or tube-like series of organs of varying sizes or lengths), and the glands which produce secretions directly into the digestive tract. Each part of the digestive apparatus has its own special work to do and is furnished with either mechanical or chemical means, or both, for doing it. A digestive juice is secreted by the mouth, the stomach, the small intestine, and the pancreas. Bile, a juice secreted by the liver, aids in the digestion of fats by preparing them for the action of the digestive enzymes. Figure 24 shows the alimentary canal as well as the glands which secrete fluids.

Processes of Digestion. The digestion of food is accomplished by mechanical and chemical means. The mechanical

processes bring about the change of foods from the solid to the liquid state, the mixture of them with the digestive juices, and their movement from one part of the alimentary tract to the next. The food is changed chemically by means of substances

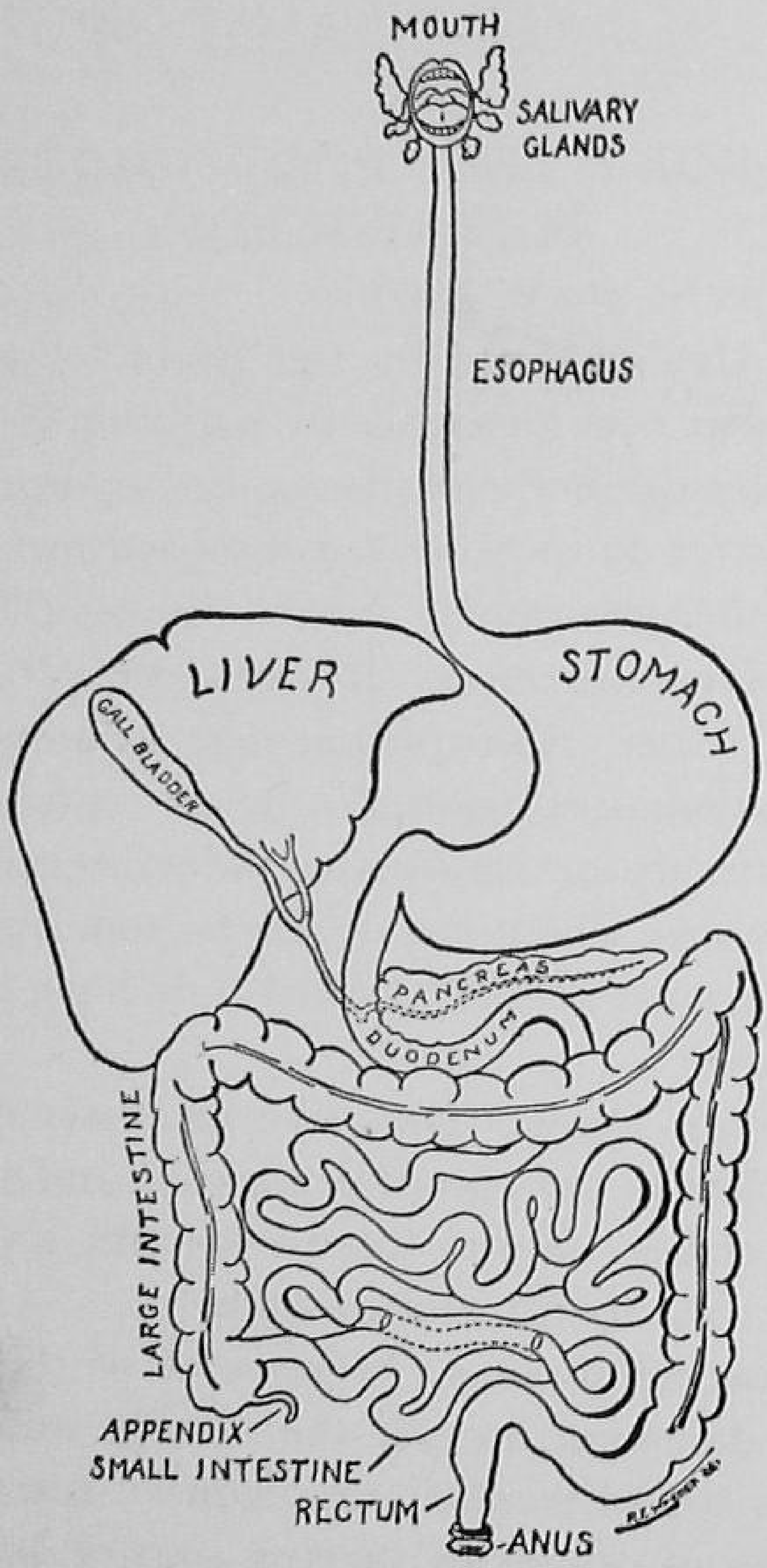

Fig. 24. Diagram of alimentary canal and glands which secrete digestive fluids. From L. J. Bogert, *Nutrition and Physical Fitness.* Courtesy, W. B. Saunders Company.

called enzymes, which are present in each of the digestive juices secreted by each part of the digestive tract. These enzymes are specific; that is, each one acts only on one kind of foodstuff. There are amylases for acting on starches, lipases for fats, and proteases for proteins. Each starch-splitting enzyme is given a special name, depending upon which juice contains it; the same is true of the lipases and proteases.

The mechanical and chemical functions of each part of the digestive tract are coordinated mainly by the sending ahead of signals to prepare the next part of the digestive tract. The sight, thought, smell, or actual presence of food in the mouth stimulates not only the saliva but also the digestive juice of the stomach; the presence of food in the stomach, in turn, stimulates later functions of digestion and sets them in motion.

Digestion in the Mouth. In the mouth, all food is acted upon mechanically by the teeth, which grind it, and by the saliva (secreted by three pairs of salivary glands), which moistens it. Starchy foods, if cooked, are further acted upon chemically by the enzyme ptyalin, present in the saliva, which has the power of changing the insoluble starch first into dextrin and then into the soluble sugar, maltose. From the mouth, the food passes through the tube-like esophagus to the stomach.

Digestion in the Stomach. In the stomach, the food is kept in motion by the muscular walls which, by their churning motion, bring all food into contact with the gastric juice secreted by the cells of the stomach. Gastric juice contains hydrochloric acid and at least two protein-splitting enzymes, rennin and pepsin, and possibly a third, lipase. Hydrochloric acid aids the action of the enzyme, pepsin. Rennin coagulates the caseinogen of milk, a necessary change before milk can be digested by pepsin. Pepsin changes the complex proteins to simpler peptones, but it does not complete the digestion of protein. The lipase, if present, acts on fats which are already in emulsified form, converting them into fatty acids and glycerol.

After the food has remained in the stomach from two to five hours, the mass is reduced to a semi-liquid state, in which condition it is known as chyme, and begins to pass into the small intestine in small amounts. The length of time which the food stays in the stomach depends upon the kind of food and the amount, as well as possibly other factors.

Digestion in the Small Intestine. The mechanical functions of the small intestine consist of mixing the chyme with the digestive juice and the movement, in peristaltic waves, of the digested food material along the intestinal tract. When the chyme enters the first part of the small intestine, it comes into contact with three juices: the pancreatic juice, which is an important digestive juice produced by the pancreas and secreted

through a duct directly into the upper part of the intestine; the bile, a fluid manufactured by the liver, stored in the gall bladder, and secreted directly into the intestine when food is to be digested; and the intestinal juice which is secreted by the glands lining the intestinal tract. All these juices are alkaline and aid in the neutralization of the chyme. Bile contains no digestive enzymes but brings about the emulsification of fats; the other two juices contain enzymes which complete the processes of digestion.

Pancreatic juice contains three enzymes: amylopsin to act on and change any starch which may have escaped the action of ptyalin in the mouth; trypsin, to act on any protein which has escaped the action of pepsin, converting it to peptones; and the lipase, steapsin, to split the fat in the food into fatty acids and glycerol. (Emulsified fats are digested by the lipase in the stomach.)

The intestinal juice contains four enzymes. One is erepsin, to complete the digestion of protein by changing the peptones into amino acids. The other three are sugar-splitting enzymes: maltase, lactase, and sucrose which complete carbohydrate digestion and convert maltose, lactose, and sucrose, respectively, into the simple sugar, glucose.

Thus it is seen that carbohydrates, fats, and proteins are changed completely to their simplest components and are ready to pass through the wall of the small intestine and be used by the body. Carbohydrates have been changed to glucose, fats to fatty acids and glycerol, proteins to amino acids. Glucose, fatty acids, glycerol, and amino acids are the end products of digestion and are absorbed in these forms. Food which is by nature indigestible or which has been made so by improper cooking is known as non-digestible residue and passes from the small into the large intestine.

Functions of the Large Intestine. Food reaches the large intestine or colon in nine or more hours after it is eaten. No enzymes are produced in the large intestine. Digestive changes that are started in the other parts of the alimentary tract continue. Water is absorbed from the contents of the large intestine, and the solid feces are formed. The feces represent both undigested and indigestible residue, as well as other substances. The elimination of this waste is important for good health. It

is aided by the residue, mostly cellulose from the foods not acted upon by enzymes, which holds water (adding moisture), and by gas-forming foods, organic acids in fruits, and such lubricants as water and fats. The amount of food residue considered necessary per day is around 6 grams.

Factors Affecting the Rapidity and Completeness of Digestion. The term digestibility of food usually refers to the rapidity and ease of digestion rather than to the completeness. Thoroughly masticated and liquid foods are more rapidly digested than food left in large pieces. The amount or type of food eaten at one meal also affects the rapidity of digestion, small meals being more quickly digested than large. Of the three organic foodstuffs, sugars are digested and leave the stomach most rapidly, proteins leave less rapidly, and fat requires the longest time for digestion. Proteins or starches mixed or coated with fat require a longer time than either one alone. Foods containing a great deal of cellulose are more slowly digested than the same foods with the cellulose removed.

Concentrated foods, such as cheese, require a long time for digestion. For this reason, cheese is ordinarily thought of as hard to digest. It is, however, completely digested.

No matter how digestible foods in themselves may be, mental factors may and do interfere with their proper digestion, slowing down the process and sometimes even suspending temporarily all mechanical and chemical action in the alimentary tract. Some of these factors are violent emotion, excitement, anger, excessive fatigue, fear, worry, or strain of any kind.

Good digestion is also influenced by and depends upon the regularity of meals, slow eating, thorough mastication, eating lightly when nervous or upset, a cheerful frame of mind, and pleasant and happy conditions at meal time. "Appetite juice" or the so-called psychic secretion is conducive to good digestion. Appetite juices are secreted at the thought, sight, smell, and taste of agreeable and appetizing food and play a considerable part in initiating the secretion of the true digestive juices. Certain vitamins are known to influence the appetite and the proper functioning of the digestive tract.

Fiber as a Factor in Intestinal Hygiene. *Composition.* Fiber or cellulose is classed with starch as a carbohydrate, as before mentioned, and is a substance which forms the cell walls

in all plants as well as the framework of the plant. The amount of cellulose present varies in different parts of the plant and at different stages of plant growth. It is more abundant in old than in young plants. The increased difficulty of digesting vegetable foods as compared with animal foods is attributed to the presence of cellulose which, by enclosing the nutrients in a fibrous envelope, prevents free access to digestive juices.

Value of Cellulose. Though possibly some animals can digest cellulose, the human digestive tract is furnished with no enzymes for this purpose. It is, therefore, not considered a food material since it is of no use to the body as a whole. It has an important function in the intestinal tract, however, in giving a certain amount of bulk or indigestible residue to the food, acting as a stimulant to peristaltic action. Ordinarily, the absorption of minerals and water is so complete and that of the proteins, fats, and carbohydrates so nearly complete that without something of the nature of cellulose there would be no stimulus to the intestine to get rid of waste. For this reason cellulose or fiber favors intestinal hygiene and helps to prevent constipation.

Cellulose in Foods. Foods containing considerable amounts of cellulose or residue are fruits and vegetables with skins and seeds and whole cereals with their outer layers of bran. Milk, refined cereals, and their products (meats, fats, potatoes, and sugar) have a very low roughage value. Cellulose in natural form in foods is probably more desirable for most persons than the addition of cellulose (bran) in some form to foods or its use alone.

Effects of Cooking on Cellulose. Moist heat softens cellulose, that in young vegetables being more easily softened by boiling than that in more mature fruits and vegetables. Baking soda will hasten the softening process but, because of its undesirable effects on the vitamin content of the food, its use for this purpose is not encouraged. Sugar added during the cooking of fruits tends to toughen the cellulose and help the fruits retain their shape.

Other Factors of Importance for Good Intestinal Hygiene. Cellulose is only one of the factors for controlling constipation and promoting good intestinal hygiene. Foods which form gas in the intestinal tract, such as cauliflower, broccoli, onions, turnips, Brussels sprouts, and cabbage, and sugars which form

gas when acted upon by fermentative bacteria, also stimulate the action of the intestinal tract. The organic acids present in fruits and the acids produced from the fermentation of foods are also effective in this respect. Undigested food fats and water aid in intestinal hygiene by lubricating the contents of the intestinal tract, thus facilitating evacuation. Buttermilk and acidophilus milk in the diet assist in establishing a favorable bacterial flora in the intestine.

Absorption of Food. The process by which the end products of digestion pass through the walls of the small intestinal tract into the blood and lymph is known as absorption. The means is osmosis. The greater part of the absorption takes place in the small intestine, the walls being lined with finger-like projections or villi, containing capillaries, arteries, and veins. The spaces between the capillaries are lacteals or lymph vessels.

The simple sugar, glucose, and the amino acids are absorbed directly into the blood stream, being taken up by the capillaries and carried to the liver by the portal system. Fatty acids and glycerol are recombined into tiny fat globules in the intestinal membrane, pass into the lymph, and are later emptied into the blood. Minerals, salts, vitamins, and water are also absorbed from the intestine and in this form utilized by the body.

Metabolism or the Fate of Food. As previously stated, metabolism constitutes the changes which occur to the end products of digestion after they have been absorbed and reach the tissues. When these materials are used for building purposes, the process is one of building up, called anabolism. When either the food substances or reserve materials in the body are oxidized to liberate energy or are broken down in ordinary wear and tear, the process is one of breaking down and is known as catabolism. All these changes take place within the tissues of the body.

The "fate of foodstuffs" refers to what happens to the simple forms of the carbohydrates, fats, and proteins after they reach the tissues. The glucose, produced in carbohydrate digestion, replaces the glucose of the blood and is burned, yielding energy for external activity, internal activity, or heat and resulting in the formation of carbon dioxide and water. Any additional glucose is stored in the liver as glycogen, to be released in the

TABLE 24

DIGESTION AND METABOLISM OF CARBOHYDRATES, FATS, AND PROTEINS

Foodstuff	*Changes Occurring During Digestion:* In the Mouth	In the Stomach	In the Small Intestine	Form or Forms in Which Absorbed	Fate in Metabolism
Carbohydrate	Starch → Dextrin → Maltose by the action of ptyalin	No action	Starch → Dextrin → Maltose by the action of amylopsin from the pancreatic juice Sucrose, Lactose, Maltose → Glucose by the action of sucrase, lactase, and maltase from the intestinal juice	Glucose	Glucose → Oxidized for energy to CO_2, which is excreted by the lungs, and H_2O, which is secreted by the kidneys Glucose → Changed to glycogen, which is stored in the liver Glucose → Changed to fat, which is stored as fatty tissue
Fats	No action	Emulsified fats → Fatty acids and Glycerol by the action of gastric lipase	Fats → Fatty acids and Glycerol by the action of steapsin from the pancreatic juice	Fatty acids and Glycerol (recombined into a new fat during absorption)	New fat → Oxidized for energy to CO_2, which is excreted by the lungs, and H_2O, which is secreted by the kidneys New fat → Stored as fatty tissue
Proteins	No action	Proteins → Proteoses → Peptones by the action of pepsin from the gastric juice	Peptones → Amino acids by the action of erepsin from the pancreatic juice	Amino acids	Amino acids → Builds new tissue protein Amino acids → Repairs old tissues Amino acids → Nitrogen is removed, changed to urea, and excreted by the kidneys. The remaining carbon, hydrogen, and oxygen are converted into glucose, which has the same fate as the glucose formed from carbohydrates.

form of glucose as it is needed in the blood. A further excess may be converted into fatty or adipose tissue.

The fats that are absorbed through the intestinal wall and carried to the tissues are also burned for energy with the production of carbon dioxide and water. Any excess not needed for energy immediately is stored as fatty tissue. To a slight extent only, fat may be converted to carbohydrate. The amino acids from the digestion of proteins are absorbed into the blood, taken up rather rapidly by the tissues, and recombined to make new tissue or to repair old. If any of the amino acids are not used, they cannot be stored as can excesses of carbohydrates and fats. The nitrogen is removed from the leftover amino acids, changed into a substance called urea, and eliminated by the kidneys. The rest of the amino acid molecule (carbon, hydrogen, oxygen) may be converted into glucose and used in the same way as the glucose formed from the carbohydrate in the food. Some change to fat may also occur.

By means of metabolic changes just described, the tissues of the body are able to obtain the necessary food energy and building material. The proper functioning of the glands of internal secretion or the ductless glands is a necessary requirement for these metabolic processes.

Summary of Digestion and Metabolism. Table 24 shows the steps through which carbohydrates, fats, and proteins pass from the time of ingestion to their final fate in the body.

QUESTIONS AND ACTIVITIES

1. Why is digestion necessary for practically all foods before the body can make use of them?
2. List all the conditions which you think might affect the processes of digestion. Which do you consider the most important?
3. Formulate all the rules which you think essential for good digestion.
4. How does cooking affect the digestibility of foods?
5. List all the foods which you have heard individuals mention as being indigestible. Can you explain possible causes for these experiences?
6. Why is cellulose (indigestible carbohydrate) necessary for good intestinal hygiene?

7. List the foods high in cellulose which might be used on a diet for constipation. List foods which are low in cellulose.

8. List the foods which you ate at your last meal. Trace the digestion of these foods.

9. Plan a high-roughage and a low-roughage menu, making any necessary changes in the foods or the form of the foods.

10. When might it be desirable to choose the high-roughage menu? The low-roughage menu?

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UNIT TWO

FOODS FOR GOOD NUTRITION

CHAPTER VIII

NUTRITIVE VALUES OF FOODS

Essentials for Good Nutrition Reviewed. In Unit One, the essentials for good nutrition were discussed in detail. They may be summarized briefly as follows.

1. Sufficient amounts of energy (calories) to cover the energy needs of the body, and, at the same time, to maintain the proper weight for one's height and age or to meet any additional needs for storage during growth or for the purpose of gaining weight.

2. Sufficient amounts of the right kind of protein to provide for growth and repair of body tissues and to supply certain constituents for the manufacture of important body compounds.

3. Sufficient amounts of the minerals, calcium, phosphorus, iron, iodine, and copper as well as, possibly, less well-known minerals for building and regulatory processes.

4. Sufficient amounts of vitamin A and carotene, vitamin D, thiamin (vitamin B_1), riboflavin (vitamin G), niacin (nicotinic acid), ascorbic acid (vitamin C), and possibly other vitamins for the promotion of good health and general well-being.

5. Adequate amounts of water and food residue for certain regulatory processes.

Carbohydrates, fats, and proteins supply energy; proteins, mineral elements, and water build and repair; and mineral elements, vitamins, water, and indigestible residue regulate body processes.

How Foods Contribute to Nutritional Essentials. A study of nutrition includes not only the requirements of the body for certain substances but also the contributions which the different kinds of foods make to what is known as the daily dietary. Since no single food furnishes all the nutrients in the right proportions needed for good nutrition, one must learn what the im-

portant nutritional characteristics of the chief types of food are. This enables him to draw up intelligently a plan for his diet much as the architect draws up his plans, specifying the different types of material required for the different parts of the finished structure.

Foods Grouped According to Nutritive Values. As stated above, single foods vary in the proportions of each of the nutrients present. The nutritive characteristics of the foods, therefore, vary as well. However, many single foods having a similar chemical composition and nutritive value may be grouped together according to their most significant nutritional characteristics. The usual grouping includes milk and milk products; grains and grain products; fruits and vegetables; meats, covering fish and poultry; eggs; fats; sugars. Sometimes, eggs are included with the group of meats.

Such a grouping of foods into larger classes makes for convenience in studying nutritive values and aids in the substitution of one food for another within any one food group.

Nutritional Contributions of Food Groups. *Milk and Milk Products.* Milk contains the greatest assortment of nutritional essentials of any of the foods. It is an important source of energy, protein, mineral elements, and vitamins. It is the best food to supplement nutritional deficiencies of grains and should be the foundation of an adequate diet at all ages and economic levels. Milk is an outstanding source of calcium but lacks iron and ascorbic acid.

Grains and Grain Products. These foods are economical sources of energy and a protein less complete than those from animal sources. Whole-grain products contain minerals and vitamins. As a class, grains are low in calcium and complete protein.

Fruits and Vegetables. Fruits and vegetables vary in protein and energy value; both are generally low except legumes. They are important for mineral elements, vitamins, base-forming elements, and indigestible carbohydrates (cellulose).

Meats, Fish, and Poultry. These foods are excellent sources of protein; meats with fat provide fat. Lean meats are good for riboflavin and thiamin and are rich sources of iron; they are deficient in calcium.

Eggs. Eggs resemble meats in protein, iron, and riboflavin content and milk in vitamin A and calcium content, although they contain less of the latter. They also furnish vitamin D.

Butter and Other Fats. These fats are a concentrated form of calories. Butter and reinforced or fortified margarines contain vitamin A; some fats, vitamin D.

Sugars. Sugars and sweets also provide calories in concentrated form. Molasses, maple sugar, and honey contain small amounts of minerals.

Ways of Presenting Nutritive Values Graphically. If a diet made up of the foods discussed in the previous section is to be judged scientifically, the foods must be interpreted in terms of calories, protein, minerals, and vitamins. The chemists and investigators of nutrition have furnished us with extensive tables of food values that tell us the exact composition of food materials. (See page 34.)

A graphic representation of the contributions of foods to the diet helps in appreciating nutritive values. For this representation there is a necessity for some common measure or some means of reducing energy expressed as calories; protein, calcium, and phosphorus expressed as grams; vitamins A and D expressed as International Units; and iron, thiamin, riboflavin, niacin, and ascorbic acid expressed as milligrams to a common factor. This may be done in two ways: the method by which food values are expressed in terms of shares and the method by which comparisons of nutritive values of foods are made on the basis of how much they contribute (in percentages) to whole dietary requirements.

Share Method. The share method was first described by Mary Schwartz Rose in 1927 and was recently revised by Clara Mae Taylor and explained fully in her publication, *Food Values in Shares and Weights,* which gives food values in shares. Briefly, a share of each nutrient, as first defined by Mrs. Rose, is simply one-thirtieth of the recommended allowance for that nutrient for a moderately active man * (taken as a standard) and yields the following figures.†

* Table 9, page 19.

† Taylor, C. M., *Food Values in Shares and Weights,* The Macmillan Company, 1942. Page 2.

1 calorie share	equals 100 calories (3,000 ÷ 30)
1 protein share	equals 2.33 gm. of protein (70 ÷ 30)
1 calcium share	equals 0.027 gm. of calcium (0.8 ÷ 30)
1 iron share	equals 0.4 mg. of iron (12 ÷ 30)
1 vitamin A share	equals 167 I.U. of vitamin A (5,000 ÷ 30)
1 thiamin share	equals 0.06 mg. of thiamin (1.8 ÷ 30)
1 ascorbic acid share	equals 2.5 mg. of ascorbic acid (75 ÷ 30)
1 riboflavin share	equals 0.09 mg. of riboflavin (2.7 ÷ 30)

The recommended allowances for each nutrient for a moderately active man are therefore calculated and stated in shares as follows.

Nutrient	*Daily Allowance* * *(for moderately active man)*		*Shares*
Calories	3,000	divided by 100	30
Protein	70 gm.	divided by 2.33	30
Calcium	0.8 gm.	divided by 0.027	30
Iron	12.0 mg.	divided by 0.4	30
Vitamin A	5,000 I.U.	divided by 167.0	30
Thiamin	1.8 mg.	divided by 0.06	30
Ascorbic acid	75 mg.	divided by 2.5	30
Riboflavin	2.7 mg.	divided by 0.09	30

Note: A good diet for this man should provide 30 shares of each of the above nutrients.

To state recommended allowances in shares for a woman or child of any given age, divide the recommended daily allowances * for the given person by the appropriate share-value figure.

Procedure to show nutritive values graphically in shares.

1. Look up in an appropriate food value table the amount of each nutrient in the food, combination of foods, or meal under consideration.

2. Obtain the number of shares of each nutrient in the food, combination of foods, or meal by dividing the amount of each nutrient by the appropriate share figure (for example, calories in the food divided by 100, etc.). Or:

3. Use Taylor, C. M., *Food Values in Shares and Weights,* Table II, page 7, to determine the shares of the various nutrients in the food, combination of foods, or meal.

Example: Nutrients expressed as shares in 1 pint of pasteurized milk would be determined as follows.

* See Table 9, page 19.

Nutrient and Weight in 1 Pint of Milk			*Share Value*		*Shares*
Calories	340	divided by	100	equals	3.4
Protein	16.2 gm.	divided by	2.33	equals	6.9
Calcium	0.581 gm.	divided by	0.027	equals	22.0
Iron	1.19 mg.	divided by	0.4	equals	2.9
Vitamin A	940 I.U.	divided by	167	equals	5.6
Thiamin	.220 mg.	divided by	0.06	equals	3.7
Ascorbic acid	7.0 mg.	divided by	2.5	equals	2.8
Riboflavin	1.062 mg.	divided by	0.09	equals	11.8

Percentage Method. Procedure.

1. Look up in an appropriate table or calculate from such a table the amount of each nutrient in the food, combination of foods, or meal under consideration.

2. Determine the percentage which each food, combination of foods, or meal contributes to each of the daily recommended allowances (Table 9, page 19) for each specific nutrient for any given person of a certain age and activity.

Example: Nutrients in 1 pint of pasteurized milk expressed in percentages of the total daily recommended allowances of a moderately active man would be determined as follows. (See also Table 9, page 19.)

Nutrient	*Recommended Allowance*	*Standard*
Calories	3,000	100%
Protein	70 gm.	100%
Calcium	0.8 gm.	100%
Iron	12.0 mg.	100%
Vitamin A	5,000 I.U.	100%
Thiamin	1.8 mg.	100%
Ascorbic acid	75.0 mg.	100%
Riboflavin	2.7 mg.	100%

Note: A good diet for this man should provide 100 per cent of each of the above recommended allowances. The standard for each is, therefore, 100 per cent.

3. Determine how nearly any food, combination of foods, or meal meets this 100 per cent standard for each of the nutrients as follows. Divide the amount of each nutrient in the food, combination of foods, or meal by the figure representing the recommended allowance for the nutrient.

Food calories	divided by	3,000
Food protein, gm.	divided by	70
Food calcium, gm.	divided by	0.8
Food iron, mg.	divided by	12.0

Food vitamin A, I.U.	divided by	5,000
Food thiamin, mg.	divided by	1.8
Food ascorbic acid, mg.	divided by	75.0
Food riboflavin, mg.	divided by	2.7

Nutrient and Weight in 1 Pint of Milk				
Calories	340	divided by	3,000	equals 11.3% of 3,000 cal.
Protein	16.2 gm.	divided by	70	equals 23% of 70 gm.
Calcium	0.581 gm.	divided by	0.8	equals 72.6% of 0.8 gm.
Iron	1.19 mg.	divided by	12.0	equals 9.9% of 12 mg.
Vitamin A	940.0 I.U.	divided by	5,000.0	equals 18.8% of 5,000 I.U.
Thiamin	0.22 mg.	divided by	1.8	equals 12.2% of 1.8 mg.
Ascorbic acid	7.0 mg.	divided by	75.0	equals 9.3% of 75 mg.
Riboflavin	1.062 mg.	divided by	2.7	equals 39.3% of 2.7 mg.

Therefore 1 pint of pasteurized milk provides for a moderately active man:

11.3% of his daily requirement for calories
23.1% of his daily requirement for protein
72.6% of his daily requirement for calcium
9.9% of his daily requirement for iron
18.8% of his daily requirement for vitamin A
12.2% of his daily requirement for thiamin
9.3% of his daily requirement for ascorbic acid
39.3% of his daily requirement for riboflavin

Figure 25 shows the above data graphically.

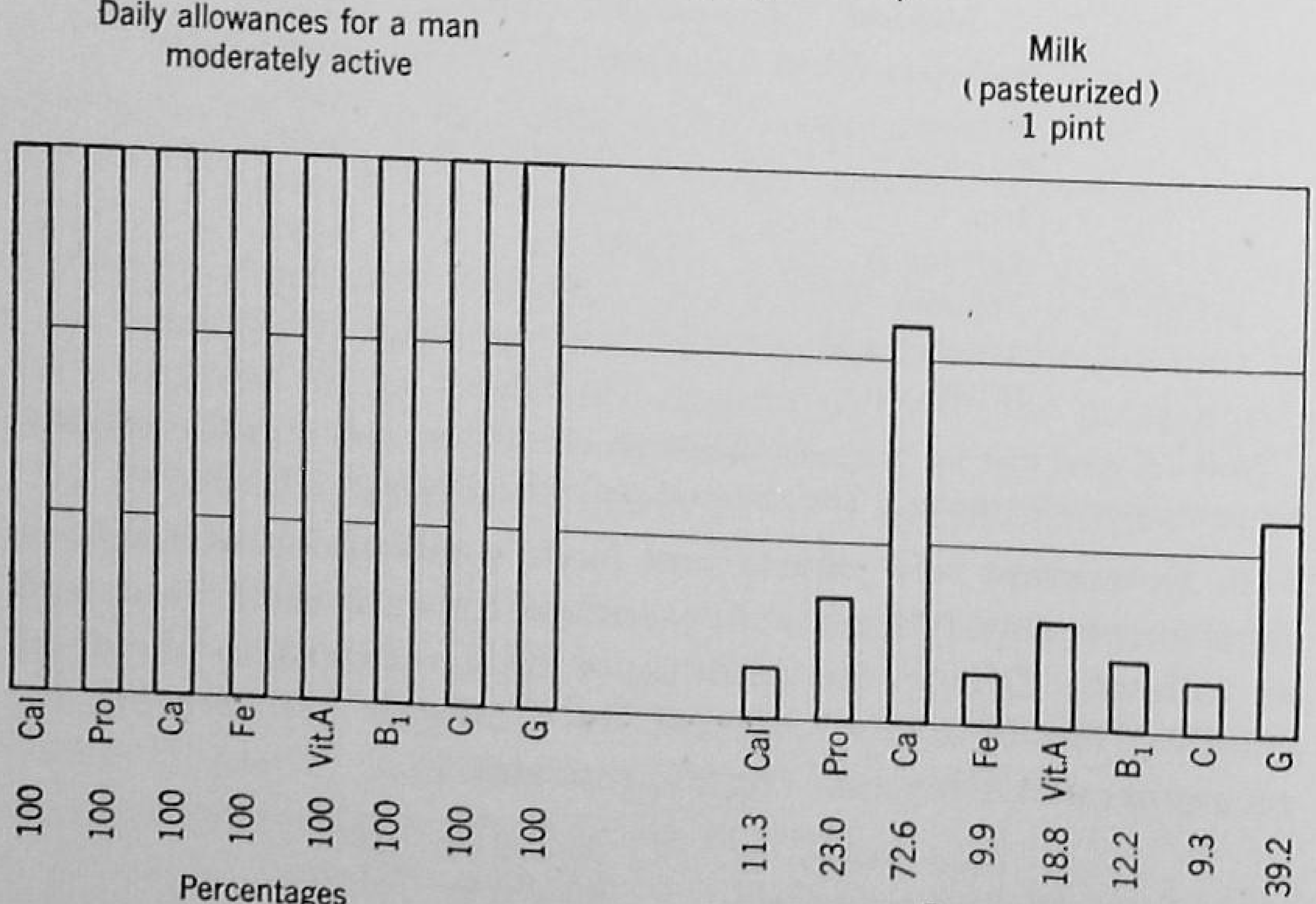

FIG. 25. Recommended daily allowances for specific nutrients compared with the nutritional contributions of one pint of milk.

REFERENCES

BOGERT, L. J., *Nutrition and Physical Fitness,* W. B. Saunders Company, Fourth Edition, 1943. Chapters I–VI.

BOWES, A. DEP., and C. CHURCH, *Food Values of Portions Commonly Served,* published by the authors. 1942.

ROSE, M. S., *Foundations of Nutrition,* The Macmillan Company, 1944. Chapter XIX.

SHERMAN, H. C., and C. S. LANFORD, *Essentials of Nutrition,* The Macmillan Company, 1943. Chapter XIX.

TAYLOR, C. M., *Food Values in Shares and Weights,* The Macmillan Company, 1942.

SOURCES OF MATERIALS FOR VISUALIZING FOOD VALUES

For the person who does not wish to or does not have the time to work out graphic representations of nutritive values, the following ready-to-use materials should prove most helpful.

Food and nutrition charts:

Minerals and Vitamins in Foods, Philadelphia Child Health Society, Philadelphia, Pa.

Vegetables for Victory, same address.

Food Color Charts, Nutrition Chart Company, Minneapolis, Minn.

Food Charts: Foods as Sources of Dietary Essentials, American Medical Association, Chicago, Ill.

Set of Food Cards, Philadelphia-Interstate Dairy Council, Philadelphia, Pa.

Know Your Foods, Metropolitan Life Insurance Company, New York City, N. Y.

Food models are also available from the following places:

Food Models—E Da 16, National Dairy Council, Chicago, Ill.

Food Cut-outs, Philadelphia-Interstate Dairy Council, Philadelphia, Pa.

Food Models, University of Chicago Bookstore, Chicago, Ill.

Food Models for Three Meals, Dairymen's League, New York City, N. Y.

TABLE 25. FOOD-VALUE CHART *

Value of food groups based on average-sized servings

Food Groups	Protein	Fat	Carbohydrate	Calcium	Phosphorus	Iron	Vitamins † A	Vitamins † B_1, or Thiamin	Vitamins † C, or Ascorbic Acid	Vitamins † Riboflavin
Fruits (1 to 1½ ounces dry or 3 to 4 ounces fresh)										
Prunes, dried	Poor		Excellent	Poor	Poor	Fair	Good	Fair	Poor	Good (?)
Apricots, dried	Poor		Excellent	Poor	Poor	Excellent	Excellent	Fair	Poor	Poor
Currants, dates, figs, raisins	Poor		Excellent	Poor-fair	Poor	Fair	Poor	Poor		Poor
Grapefruit, lemons, oranges, strawberries	Poor		Fair	Poor	Poor	Poor–fair	Poor	Poor–good	Excellent	(?)
Cranberries, cantaloupe, pineapple, raspberries, rhubarb, tomatoes ‡	Poor		Poor–fair	Poor	Poor	Poor	Poor ‡	Fair–good	Good–excellent	(?)
Bananas, sweet cherries, yellow peaches	Poor		Good	Poor	Poor	Poor–fair	Fair–good	Fair	Poor–fair	Poor
Apples, blackberries, grapes, grape juice, pears, plums, watermelon	Poor		Fair–good	Poor	Poor	Poor–fair	Poor	Fair-good	Poor–fair	Poor
Vegetables (3 to 4 ounces)										
Broccoli, dandelion greens, kale, mustard greens, turnip greens	Poor		Poor	Good–excellent	Poor–fair	Good–excellent	Excellent	Good–excellent	Excellent	Fair–excellent
Beet greens,‖ chard,‖ spinach ‖	Poor		Poor	Poor ‖	Poor	Excellent	Excellent	Good	Excellent	Fair–good
Asparagus (green), snap beans, green peppers	Poor		Poor–fair	Poor–fair	Poor	Poor–fair	Good–excellent	Fair–excellent	Good–excellent	Poor–fair
Carrots, pumpkin, winter squash	Poor		Poor–fair	Poor–fair	Poor	Poor–fair	Excellent	Fair	Poor–fair	Poor
Brussels sprouts, cabbage, cauliflower, parsnips, rutabagas, turnips	Poor		Poor–fair	Poor–fair	Poor–fair	Poor–fair	Poor–fair	Fair–excellent	Good–excellent	Poor–fair(?)
Beets, celery (bleached),¶ cucumbers, eggplant, lettuce (head),¶ onions	Poor		Poor–fair	Poor–fair	Poor	Poor–fair	Poor ¶	Poor–fair	Poor–fair	Poor
Green Lima beans, green peas	Fair	Poor	Good	Poor	Fair	Good–excellent	Good	Excellent	Excellent	Fair
Corn	Poor	Poor	Excellent	Poor	Fair	Poor	Good	Good	Fair	Poor
Potatoes, white	Poor	Poor	Excellent	Poor	Poor	Fair	Poor	Good	Good	Poor
Sweet potatoes	Poor	Poor	Excellent	Poor	Poor	Fair	Excellent	Good	Good	Fair
Legumes, dried (about 1 ounce)										
Dried beans (navy and Lima), dried peas	Fair	Poor	Good	Poor	Fair	Good–excellent	Poor	Good–excellent		(?)
Nuts (about ½ ounce)										
Almonds, peanuts, pecans, walnuts	Poor–fair	Good	Poor	Poor	Poor–fair	Poor	Poor	Fair–good		Poor–fair

Cereals and cereal products (about 1½ ounces)										
Whole-grain: bread (wheat and rye), whole-grain breakfast foods, whole-grain flours (rye, whole-wheat), brown rice, rolled oats	Fair	Poor	Excellent	Poor	Fair	Fair–good	Poor	Excellent		Poor
Enriched bread and flour	Poor–fair	Poor	Excellent	Poor	Poor	Fair–good	Poor	Good–excellent		Poor
Refined: white bread and flour, macaroni, polished rice, cornstarch, cornmeal (degerminated)	Poor–fair	Poor	Excellent	Poor	Poor	Poor	Poor	Poor–fair		(?)
Sugars (about 1 ounce)										
Molasses, cane			Excellent	Fair	Poor	Excellent		Poor		
Brown sugar, maple sirup			Excellent	Poor		Fair				
Honey, sugar (refined)			Excellent							
Animal foods (exclusive of fats)										
Whole fresh milk, unsweetened evaporated, and dried whole milk (reconstituted) (1 cup)	Good	Good	Fair	Excellent	Excellent	Poor	Fair	Good	Poor	Good
Fresh skim milk, buttermilk, dried skim milk (reconstituted) (1 cup)	Good	Poor	Fair	Excellent	Excellent	Poor–fair	Poor	Fair–good	Poor	Good
Cheese										
Cottage (3 ounces)	Good	Poor	Poor	Fair	Excellent	Poor	Poor	(?)		Good
Soft cream (1 ounce)	Poor	Good	Poor	Fair	Fair	Poor	Good	(?)		Poor
American (¾ ounce)	Good	Good		Good	Good	Poor	Good	Poor		Fair
Egg (one)	Good	Fair		Poor	Fair	Good	Good	Good		Fair
Muscle meat ** including poultry (3 to 4 ounces)	Excellent	Poor–good		Poor	Excellent	Good–excellent	Poor	Good–excellent		Fair–excellent
Liver (3 to 4 ounces)	Excellent	Fair	Poor	Poor	Excellent	Excellent	Excellent	Excellent	Fair (?)	Excellent
Heart	Good	Excellent		Poor	Good	Good	Poor	Excellent		Excellent
Kidney	Good	Fair		Poor	Good	Excellent	Good	Excellent		Excellent
Fish (3 to 4 ounces) ††	Excellent	Fair–good		Poor ††	Excellent	Fair–good	††	Good–excellent		Fair–good(?)
Shellfish (3 to 4 ounces)	Good–excellent	Poor	Poor	Poor–fair	Good	Good–excellent	(?)	Good–excellent		Fair–good
Fats										
Butter (1 tablespoon)		Excellent					Good			
Cream (⅛ cup)		Fair–excellent	Poor	Poor	Poor	Poor	Good	Poor	Poor	Poor
Cod-liver oil (1 teaspoon)		Fair					Excellent			
Lard, meat fat, salad oils, margarine ‡‡ (1 tablespoon)		Excellent					Poor ‡‡			

* New York State College of Home Economics, Cornell University. Courtesy of the Extension Service, New York State College of Agriculture.

† Unless otherwise stated, values given are for uncooked foods that are reasonably fresh and of good quality.

‡ Tomatoes and cantaloupe are good sources of vitamin A.

‖ Calcium content fair but not available.

¶ Bleached portions of vegetables, such as lettuce and celery, contain less vitamin A than do green portions.

** Pork muscle is superior to other muscle meats as a source of vitamin B_1.

†† Vitamin-A content variable: fat fish, such as salmon, are good sources of vitamin A; lean fish, such as halibut and perch, have vitamin A in the liver oils. When small bones are eaten with the fish, as in sardines and canned salmon, the calcium value is increased.

‡‡ Some margarines contain added vitamin A. Read the label.

CHAPTER IX

MILK AND MILK PRODUCTS

Milk

Milk as an Article of Food. The milk of several different animals is used as food but cow's milk is the only one of much commercial importance. Milk has always been the main source of nourishment for the infant and young child. As new discoveries have been made in nutrition, more emphasis has been placed on milk in the diet at all ages. It is now realized that the vitality of the adult is improved when milk takes a prominent place in the diet. Milk is one of the few foods that contain all the factors known to be needed in nutrition and is a food for which no fully satisfactory substitute has been found.

The average American dietary is likely to be deficient in the mineral calcium and a large proportion of families consume much less milk than the amount considered minimum for building and maintaining good bodies. These facts add still greater significance to an increased intake of milk in this country. The consumption of milk has increased greatly during the past fifty years. That it is still not sufficiently high for the best nutrition is evidenced by recent dietary studies showing the nation's need for at least 10 to 20 per cent greater milk consumption.

Production and Handling of Fresh Milk. The present century has seen a tremendous development of the dairy industry. Part of dairy science has included the development of strains of animals which are the most profitable economically. Principal types of dairy animals that have been developed include the Holstein-Friesian, Jersey, Guernsey, Ayrshire, and Brown Swiss, the first famous for large quantity milk production and the others less for quantity than for the high fat content of the milk. The principal dairy states of the United States include the New England States, New York, Pennsylvania, Ohio, Illinois, Wisconsin, Minnesota, and Iowa.

Milk Ordinance and Code. The United States Public Health Service has recommended, for adoption by all American municipalities, a Standard Milk Ordinance and Code. Many counties and cities in the majority of the states have accepted this ordinance either as a check for their milk supply or as a guide in formulating their own laws. The use of this code is voluntary. A list of all American communities in which the milk ordinance is in effect is available from the United States Public Health Service in Washington, D. C.

The Milk Ordinance defines the conditions under which milk may be produced, transported, labeled, and offered for sale. It also defines the following grades: certified raw milk, certified pasteurized milk, grade A raw milk, grade A pasteurized milk, grade B raw milk, grade B pasteurized milk, grade C raw milk, and grade C pasteurized milk. Cities which have adopted this ordinance may display in their food shops and restaurants a special insignia provided by the United States Public Health Service.

If the Standard Milk Ordinance is not adopted in any community, a state or local ordinance embodying the principles of the federal one should be in effect to safeguard the local milk supply.

Grades of Milk. As mentioned directly above, grades defined by the Federal Milk Ordinance may be adopted in their entirety by any state. If not, individual voluntary or mandatory state grades may be formulated and in use. In the absence of state grades or failure to use them for any reason, municipal or local grades may be in force. The grading and standards may vary in different localities and states, but most states require that Grade A raw milk shall have a bacterial content under 50,000 per cubic centimeter. Grade B pasteurized milk may have a higher bacterial content. The grade of milk refers only to the bacterial content of milk, but it so happens that the fat content of Grade A milks may be a little higher than the state or local minimum required. For ordinary purposes, Grade B pasteurized milk is both satisfactory and cheaper than Grade A.

Certified Milk. The American Association of Medical Milk Commissions has set requirements for the production of milk to be marketed under the designation of certified milk. Exacting conditions are demanded for its production and it is certified

as to its production and quality by a medical milk commission of the local medical society. Rules of production constitute the methods and standards of production for certified milk as adopted by the American Association of Medical Milk Commissions.

Certified milk was originally only raw milk but, in June 1935, permission was granted to pasteurize certified milk provided that the treated milk met, before pasteurization, the standards for certified raw milk and that the pasteurization and bottling were done by machinery used for no other milk. Because of the extra care of details in the production of certified milk, the bacterial count is very low and the cost per quart higher than for ordinary milk.

Special forms of certified milk include vitamin D certified and soft-curd certified milks. The former may be produced only by the method of scientifically feeding the cow irradiated yeast. It is not processed and contains no added mixtures. Each quart must contain not less than 430 United States Pharmacopoeia Units of vitamin D. It was first produced in 1931. Soft-curd certified milk may be produced only by the selection of cows which give a "natural" soft-curd milk and is required to have a curd tension below 30 grams. The ability to produce a soft-curd milk is an individual peculiarity of certain cows. Soft-curd certified milk may not be produced by treating the milk by an artificial process for softening the curd such as may be done in the production of ordinary soft-curd milk. This latter method, incidentally, is effected by removing a considerable part of the calcium.

Raw Milk. Raw milk is still available in many communities. However, it is generally agreed that all milk handled commercially should be pasteurized. Sanitary checking of milk is usually limited to the number and not always to the kind of bacteria present. Raw milk can, of course, be clean, but there is great danger of contamination in handling the raw material. Generally speaking, commercially pasteurized milk is the safest. Raw milk from questionable or unknown sources should be heated before being used for drinking purposes.

Pasteurized Milk. Pasteurization is the only method known which, if properly applied to all milk, will prevent all milk-borne diseases. At present, much of the milk produced is subjected

to this process. Two methods are in use, the "flash" and the "hold" methods. In the former, the milk is raised to a temperature of around 165° F. or 74° C., held there for 1 minute, and then rapidly cooled. In the latter, it is raised only to 142 to 145° F. or 61 to 63° C., held at that point for 30 minutes and cooled, rapid cooling being highly essential. During pasteurization, the harmful or pathogenic bacteria are destroyed, but the ones that form lactic acid are unaffected. Such milk is not proof against souring or future contamination and needs to be kept at a temperature of about 40° F.

In many cities, the sale of any but pasteurized milk is prohibited. The public health value of such a rule is significant.

Food values are not significantly impaired by pasteurization. Slight coagulation of the protein takes place, as well as some alteration in flavor and partial or complete destruction of the ascorbic acid, present in milk in only small amounts.

Homogenized Milk. This milk is defined in the Milk Ordinance as "milk which has been treated in such a manner as to insure break-up of the fat globules to such an extent that, after 48 hours' storage, no visible cream separation occurs on the milk and the fat percentage of the top 100 cubic centimeters of milk in a quart bottle, or the proportionate volume in containers of other sizes, does not differ by more than 5 per cent of itself from the fat percentage of the remaining milk as determined after thorough mixing." This process may be applied to any milk. It breaks up the fat globules and distributes the cream evenly throughout the milk. It is usually done with the higher grades of milk at a slight increase in cost.

Vitamin D Milk. Usually only milks corresponding to certified or Grade A are reinforced with vitamin D. There are three types of vitamin D milk: metabolized, irradiated, and fortified. The first is produced by the addition of controlled amounts of irradiated yeast to the feed of the cows to yield a standard number of units, approximately 400 International Units of vitamin D per quart of milk. The second type is produced by directly irradiating the milk. During irradiation, the light converts the cholesterol in the milk to vitamin D. It contains approximately 135 International Units per quart. Fortified vitamin D milk is prepared by adding a cod-liver oil concentrate (a substance richer in the vitamin than the untreated cod-liver oil) to the milk.

The resulting milk averages 400 United States Pharmacopoeia Units of vitamin D per quart or the approximate amount of the vitamin present in 1 to 1½ teaspoons of standard cod-liver oil.

Skim Milk. Skim milk is fresh whole milk from which only the fat is removed. It is, therefore, equivalent to whole milk in every way except fat and fat-soluble vitamins. It is a valuable product in the diet; it is rich in protein, sugar, minerals (being a cheap source of calcium and phosphorus), and vitamin G. If some butter or vitamin A fortified fat, and green or yellow vegetables are provided, skim milk is a valuable source of nutriment on a low-cost diet.

Processed Milks. Processed milks include the better-known evaporated, condensed, and dried milks and the less known condensed buttermilk, skim milk, and dried buttermilk.

Evaporated Milk. Evaporated milk is prepared from whole milk from which part of the water is removed by evaporation under pressure and which is subjected to a temperature usually around 226° F. Approximately 2 to 2½ parts of whole milk are reduced to 1 part of evaporated milk with a total milk solids content of not less than 25.5 per cent. Evaporated milk, when diluted with an equal amount of water, is practically equivalent to the same amount of fresh milk. The change in flavor noted in evaporated milk is caused partly by the effect of heat on the protein content and partly by the effect on the sugar in the milk.

Irradiated Evaporated Milk. Irradiated evaporated milk is prepared by concentrating whole fresh milk by the removal of approximately 60 per cent of water, irradiating it with ultraviolet light rays to increase the vitamin D (under the license from the Wisconsin Alumni Research Fund), homogenizing it to distribute the butter fat, hermetically sealing it, and sterilizing it.

Condensed Milk. Condensed milk is also made from fresh whole milk by dehydration, but 15 to 18 per cent of sugar is added to it, resulting in as much as 40 per cent of sugar in the final product.

Dried Milk. Dried milk is prepared from whole fresh milk, partially skim milk, or skim milk by first concentrating the milk in vacuum pans and then drying it by one of three methods. By the first method, revolving drum driers dip into the concentrated milk. The resulting thin film formed on the drum, during one revolution, is then scraped off and ground into a powder. The

spray method provides a more soluble product than the drum method. Here concentrated, homogenized milk is sprayed under pressure into heated chambers in the form of fine mist. The water is removed instantly and the milk falls to the bottom of the drier in the form of a powder. Low-fat milks, as skim milk and buttermilk, can be dried only by the flake-film method which involves drying the concentrated milk on an endless belt traveling through a dehydrating tunnel.

Dried milks are graded by the American Dry Milk Institute as Extra, Standard, and 3rd Grade. More dried skim milk is produced than dried whole milk, probably because the absence of fat allows for better keeping qualities. Dried whole milk is 26 per cent butter fat and 5 per cent or less moisture, whereas dried skim milk is 1½ per cent butter fat and 5 per cent or less moisture.

Chocolate Beverages. Commercially prepared chocolate beverages are made by the addition of a commercial chocolate or cocoa sirup to whole or skim milk. In order to be called "Chocolate Milk," whole milk must be used. Chocolate beverages made with skim milk must be labeled "Chocolate Drink." Chocolate beverages may be made more economically at home with a home-prepared sirup added to whole milk. For greater nutritive value, a chocolate beverage made with partially diluted evaporated milk and sirup is recommended in place of the commercially prepared product.

Care of Milk. As milk forms a very attractive medium for the growth of bacteria, absolute cleanliness and a low temperature are essential in handling it. Though many different types of bacteria may be found in milk, milk coming from reliable dairies usually contains no harmful variety. The predominating type of bacteria is the sort that forms lactic acid; this may well be considered beneficial because it gives rise to the acid which acts as a deterrent to the growth of a type of bacteria which, if allowed to multiply, would cause the putrefaction of the protein. Milk directly from the cow usually registers about 100° F.; the custom now prevails of lowering it, either in raw or pasteurized form, to 40° F. as quickly as possible and keeping the milk at that point until ready for consumption.

As milk is known to absorb odors very readily, it should be kept in a perfectly clean and odorless ice box in a tightly covered

receptacle. Owing to modern refrigeration, sanitary methods of production, and the prevalence of pasteurization, milk will now keep in good condition for several days.

Unopened cans of evaporated milk will keep indefinitely. The cans should be turned from top to bottom occasionally if kept for a very long period of time. After the cans are opened, the milk should be treated as fresh milk and the same care given it. The contamination of the milk will probably be lessened by leaving in the refrigeration immediately unused portions of the milk in the can.

Composition and Nutritive Value of Milk. Milk, usually understood in this country to mean cow's milk, varies a little in composition and can be safely counted upon to contain about 87 per cent water, 3 to 4 per cent protein, 3 to 5 per cent fat, 4 to 5 per cent carbohydrate, and 0.7 per cent mineral matter.

All the substances known to be essential to good nutrition are contained in milk although some are present in very small quantities. Fat is present in milk in the form of cream which, in freshly drawn milk, is in such a fine state of emulsion that the fat globules are held in suspension. However, these fat cells are so much lighter than water that the cream rises to the top when the milk has been allowed to stand. When this cream is separated and shaken or churned, the albuminous coating of the fat cells is broken and the contents merge, forming butter.

Carbohydrates occur in milk in the form of the sugar, lactose; it is only in milk that this substance occurs naturally. It is not as sweet as sucrose and does not ferment as readily, but it can be acted upon by a type of bacteria which splits it with the formation of lactic acid.

Protein occurs in milk in the form of casein, which is held in combination with calcium salts in the form of calcium caseinate, and in the form of lactalbumin. Eighty per cent, 0.5 per cent, and 0.005 per cent of the total protein in the milk are in the forms of casein, lactalbumin, and another protein, called lactoglobulin, respectively. Casein is the important protein in cheese making as it can be precipitated by coagulation with acid (curdling) or by an enzyme (clotting); lactalbumin is unaffected by acid and rennin although it is coagulated by heat. Both casein and lactalbumin are complete proteins.

Minerals occur in milk, mainly in the form of calcium, found

in relatively large amounts, fairly large amounts of phosphorus, magnesium, potassium, sodium, some iodine, and a very small amount (but an efficient form) of iron. The mineral content is well balanced with the exception of copper and iron, and the proportion of calcium to phosphorus is considered good. Milk is especially valuable for its calcium content.

All vitamins are present in milk in varying amounts but with better proportions of more of them than in many other foods. The vitamin A value is variable, being dependent upon the amount of green foods the cow has in her diet. Winter milk is lower in vitamin A value when the herds are off green feeds which contain carotene, the precursor of vitamin A. In some modern dairies, cows are stall fed the year round with vitamin-rich green foods dehydrated in such a way that all nutrients are retained, with the result that the milk has a uniform vitamin A value of 200 to 255 International Units per quart, without seasonal variation. Ordinary sun drying or curing of green foods causes loss of most of the vitamin A value.

Milk is a better source of vitamin G than B, the former being associated with the greenish yellow pigment in the whey of milk. Vitamin C is present in fresh milk in small amounts but is so unstable that it is lost with light, when milk is heated, especially in the presence of oxygen.

The amount of vitamin D varies in milk, its presence being dependent on the season and the amount of sunshine received by the cow. Summer milk may be nine times as rich in vitamin D as winter milk. Milk may contribute more vitamin D to the diet than is appreciated because of the fact that it is used in so many different forms.

Skim milk contains the protein, calcium, phosphorus, sugar, and water soluble vitamins present in whole milk and therefore makes a notable contribution to the diet. Processed milks have practically the same food value as fresh whole milk with the exception of vitamin C. Evaporated milk loses most of its vitamin C because of the heat to which it is subjected. Condensed milk may have slightly more, as a lower temperature is used to sterilize it; added sugar acts as a preservative. Considerably more vitamin C may be retained in dried milk, as the heat applied in drying the milk, while high, is applied for such a short time.

Milk Equivalents. Seventeen ounces of evaporated milk, 5 ounces of American Cheddar cheese, 1 quart of fluid skim milk plus 1½ ounces of butter, 4½ ounces dried whole milk, or 3½ ounces dried skim milk plus 1½ ounces of butter equals 1 quart of fresh whole milk.

Place of Milk in the Diet. Mrs. Rose has said that no other food can so well serve as the foundation of an adequate diet as milk because no other food reinforces the diet at so many points. Milk, especially for children, may be used either alone or combined with foods in cooking. To vary it for older children and adults, chocolate or cocoa sirups may be added occasionally. It may also be taken in the form of milk shakes and eggnogs. Cream soups, creamed vegetables, and desserts and beverages containing milk may be enjoyed and well digested by those persons who seem to have an aversion to drinking milk alone. For health protection, every child needs daily 3 to 4 cups of milk; every adult needs 1½ to 2 cups to furnish plenty of calcium as well as to supplement the diet in other dietary essentials. It is difficult to meet the daily calcium requirement unless sufficient amounts of milk in some form are consumed. The Bureau of Human Nutrition and Home Economics has recommended 260 quarts of milk per person per year, but actual studies of milk consumption have indicated that only 225 quarts per person are consumed on the average per year.

Milk provides the most efficient, as well as economical, way of supplementing the calcium and vitamins lacking in cereal products. It is a protective food since it enriches the diet in calcium and vitamin A.

The following figures show how dairy products contribute to the daily calcium requirement (0.8 gram) of an adult woman. Seventy-three per cent of the daily calcium requirement of an adult woman is supplied by 1 pint of milk, 78 per cent by 1 pint of skim milk, 66 per cent by 1 pint of buttermilk, 24 per cent by 1 cube of American cheese, 7 per cent by 2 ounces of cottage cheese, and 7 per cent by 2 eggs.

Figure 25 on page 116 shows graphically the nutritional contributions of 1 pint of milk to daily requirements of an adult man.

Souring of Milk. When milk is allowed to stand too long or at ordinary room temperature, the bacteria in it attack the

lactose and change it to lactic acid which, in turn, acts upon the casein, causing it to be precipitated. Lactic acid and the calcium of the calcium caseinate combine and the casein is freed. As this casein is not stable, it precipitates. This action gives to sour milk its characteristic curdled appearance. Among primitive peoples, souring of milk is brought about as quickly as possible to preserve it. Paradoxical as this may seem, it is true in so far as the growth of the beneficent lactic acid checks that of the protein-splitting or less desirable bacteria.

Buttermilk is obtained from the cream used for making butter but may also be produced by means of lactone tablets and whole milk. Acidophilus milk is a cultured milk used by many as it is known to encourage the growth of desirable bacteria in the large intestine. Sterilized milk and acidophilus culture are used in its production. Kumiss, matzoon, and Bulgarian milk are all fermented milks.

Digestibility. Milk is a liquid outside the body, but it becomes solid when it reaches the stomach, as the rennin of the gastric juice acts upon the casein, forming or producing a clot, which sometimes is sufficiently tough and leathery to interfere with the proper digestion of the protein. This can be overcome by heating the milk or adding to it certain substances which will separate the protein and prevent it from forming such a compact mass. Some of these are plain water, barley water, lime water, or acid in the form of fruit juice.

In some cases, especially babies and young children, there may be an advantage in using milk that forms a flocculent or soft curd. Such milk may be produced by certain cows. Ordinary market milk may be treated with an artificial process that softens its curdling properties. This latter is accomplished largely by removing some of the calcium.

The fat in milk is one of the most easily digested of all forms of fat, owing, probably, to the very fine state of emulsification in which it exists. The homogenizing process is thought to make the milk slightly more digestible.

Changes in Cooking Milk. When milk is heated, a change in the odor and flavor occurs because of the loss of the dissolved gases, oxygen and carbon dioxide. Physical changes including the formation of a film on the top of the milk (calcium caseinate) and a coating (coagulated albumin) on the sides of the pan occur,

probably with the occlusion of some calcium salts. With continued or excessive heat, further coagulation takes place with changes occuring in the casein; a discoloration, caused by the caramelization of the lactose, may also occur.

Milk is coagulated by rennin, the commercial form of which is obtained from the calf's stomach and is available in liquid or tablet form. Rennin changes casein to paracasein which sets in a smooth homogeneous mass. Rennin is ineffective with milk that has been heated to too high a temperature, excessive acid (slight acid is the most favorable for rennin action), diluted milk, evaporated milk, or a soft curd milk. It is also ineffective in coagulating milk in the presence of fresh pineapple or pineapple juice. Pineapple contains an enzyme, bromelin, which is inactivated by heat and which digests the milk protein.

Cheese

Cheese as an Article of Food. Cheese is the first form in which milk was preserved for future use and also the first commercial product to be manufactured from milk. There is a great variety of cheeses and it is an important item of the diet in a number of countries. The United States is one of the lowest cheese-consuming countries, although the consumption and production have increased since 1929. For people in the United States, cheese has formerly been an additional item in the diet; for Europeans, it has been a main dish. However, as meat becomes scarce or more expensive, cheese provides an important meat substitute.

Production and Types. The curd produced by the precipitation of the casein in milk, by acid or rennin or both, is the basis of all cheese production. Cheeses are designated as hard or soft, depending upon the amount of moisture left in them; as ripened, if allowed to be acted upon by various kinds of microorganism, or unripened, if not so treated. Soft cheeses may contain as much as 25 to 75 per cent of moisture and the hard less than 40 per cent. Ripened cheeses vary widely in flavor due to the specific microorganism activity as well as regional conditions under which they are produced.

Cheese is produced by the sterilization or pasteurization of milk of known fat content, and the formation of a clot by the

addition of lactic acid culture and rennin. Curds formed by the natural souring of milk preceded the commercial process of adding rennin. The clotted milk is then cut and mixed to separate the whey, drained and worked, salted, and pressed. Ripening then takes place for varying lengths of time, during which time the product is kept under such conditions as will encourage the desirable organisms.

Hard cheeses include Parmesan, Swiss, Cheddar, American Cheddar, and Edam; semi-hard cheeses include brick, Stilton, Gorgonzola, Roquefort; soft cheeses include Brie, Camembert, Limburger, Neufchâtel, cream, and cottage. American Cheddar is perhaps the best known in this country, two-thirds of the cheese produced here being of the Cheddar type.

Composition and Nutritive Value. Cheese is a very concentrated food containing approximately 28 per cent protein and 35 per cent fat. The food value depends upon the kind of milk used in its production. This may be skim, whole, or either, combined with cream. Generally speaking, cheese has practically the same food value as the milk from which it was produced, but it is more concentrated. Like milk, it is a protective food. Its protein is complete. Since most Cheddar cheese is made from whole milk, it is high in fat. If it is made from whole milk, it is an excellent source of calcium and vitamin A. A third of a pound of cheese is about equivalent to 1 quart of milk. One pound of cheese contains the casein and fat of 1 gallon of milk and traces of whey.

Commercial cottage cheese or pot cheese is usually made from skim milk. A so-called "creamed" cottage cheese, cottage cheese to which a certain amount of cream is added and the mixture made very smooth, is available in some localities. Cottage cheese, made by coagulating milk with rennet, contains more calcium than that made by coagulation with acid.

Place in the Diet. Cheese is high in protein and fat and therefore should be used in place of meat and eggs in the diet, rather than in addition to them. Its more extensive use in the diet could well be recommended, especially in low-cost diets, as it is a relatively inexpensive protein food. The deficiency of cheese in carbohydrate makes it a good combination with such starchy foods as rice and macaroni. Because of its high degree

of concentration, it may well be served with such vegetables as give bulk.

Cheese and eggs in the forms of soufflés, fondues, rabbits, and baked eggs with cheese make substantial main dishes. Grated cheese may be added to the dry ingredients of muffins and biscuits; ½ cup of cheese may replace 2 to 4 tablespoons of fat in a muffin recipe; ½ cup grated cheese may be used in biscuits when the recipes call for 1 to 1½ or more cups of flour.

It is estimated that cheese gives approximately twice as much food value for the money spent as meat. Two ounces of American cheese make the following contributions to the diet of a moderately active man: 8.6 per cent of his daily calories, 24.8 per cent of his daily protein, 64.8 per cent of his daily calcium, 6.3 per cent of his daily iron, 36.0 per cent of his daily vitamin A, 1.4 per cent of his daily thiamin, 11.5 per cent of his daily riboflavin.

Digestibility. Contrary to the prevailing idea that cheese is indigestible, there seems to be ample proof that, though slow to digest, it is quite completely digested. The fact that it is so often served at the end of a meal already sufficient in quantity and quality and that it accompanies such desserts as rich pies and puddings perhaps explains the bad repute in which it is held. The idea that the addition of baking soda to cheese recipes makes for better digestibility does not seem to be justified. Its action probably impairs the flavor, as it neutralizes the fatty acids upon which some of the characteristic flavor depends. When cheese is used with other foods, its good digestibility should be insured. Any discomfort that is the result of eating cheese may be caused by the volatile acids, by the fact that the high fat and protein content causes it to remain in the stomach for some time, or by eating too much at one time. It has been proved by experiments to be 95 per cent digestible.

Cheese Cookery. When applying heat to cheese dishes, a low temperature should be used to prevent toughening, hardening, and stringiness. Cheese is heated only to dissolve the fat, which may be done at a low temperature. Cheese dishes should be heated the shortest possible time. Dry heat causes cheese to smoke with a disagreeable odor. Sodium bicarbonate is sometimes added to dissolve the cheese and facilitate its mixing. It also neutralizes some of the fatty acids present and changes the

characteristic flavor. The heat may be kept low when cooking cheese dishes on top of the stove by cooking over hot water. Use slow heat for oven dishes.

Cut cheese into small pieces, grate, slice, cube, or put it through a grinder before combining it with other ingredients or adding to a white sauce. Cheese in these forms will cook more quickly and can be distributed more evenly.

QUESTIONS AND ACTIVITIES

1. As a class, carry on the following demonstration with rats to show the effect of milk on growth. Secure four white rats one month old from the same litter and of the same sex if possible. Place two rats of the same sex in one cage and feed daily several crackers soaked in water. Place the other two rats of the same sex in another cage and feed these daily several of the same kind of crackers soaked in milk. Weigh all rats every week and plot their weight curves for four to six weeks. At the end of this period, give all rats crackers and milk for a couple of weeks, continuing to weigh them weekly and plot weight curves. Note the change in rate of growth of the rats started on crackers and water when they are given the crackers and milk and how long it takes them to reach the size of their litter mates. Doughnuts and coffee may be fed in place of crackers and water and oatmeal and milk or whole-wheat bread and milk in place of the crackers and milk.

2. What do you think of the statement "Milk is a perfect food"?

3. What are the regulations in your city and state regarding the production and handling of milk? Is the United States Public Health Service Ordinance in effect?

4. Study your three days' food record from Activity 4, Chapter I. Does the amount of milk present meet the standard of 3 to 4 cups per day? If not, have you increased the amount of milk in your diet since making this record? Why is it essential that every individual, young and old, receive his full quota of milk every day?

5. Keep a record of the amount of milk purchased and used by your family for 1 week. Does the total give a daily average of 3 to 4 cups per child and 1 to 1½ cups per adult? If not, make suggestions for the use of more milk for your family.

6. Some persons find they enjoy milk better if it is combined with other foods. Make a list of the foods which could appear at the three meals and which contain a total of 3 cups of milk. Indicate for each dish the approximate amount of milk contained.

7. List ways, other than those mentioned in 6 above, for using milk

in dishes. How can dried and evaporated milk be used in cooking? Look up recipes for using evaporated milk. How much evaporated milk and water are equivalent to one quart of fresh milk? How much dried milk and water?

8. Should a family with a limited income economize by reducing the amount of milk purchased? Why? Without reducing the amount of milk required, how could a family reduce its milk bill?

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CHAPTER X

FRUITS

Fruits as an Article of Food. Fruits have always been popular in man's diet but not always in the cultivated form with which we are now familiar. Wild fruits were formerly sought for their flavor and the variety which they added to the diet. Now, there is hardly a community in which a fairly wide array of fruits is unavailable.

In the United States, oranges, bananas, apples, grapes, and peaches have been consumed in large quantities, grapefruit, pears, and strawberries also being popular. The factors responsible for the decided upward trend in the consumption of fruits during the past fifty years include improvement in cultivation, transportation, refrigeration, and storage, early harvesting and artificial ripening, and greater availability of frozen fruits. Citrus fruits have become daily food staples rather than the luxury formerly purchased only at holiday time. The yearly production of oranges has increased from 20 million boxes in 1920 to 80 million at the present time. Grapefruit came into great popularity about 1930. Recent dietary studies indicate that the nation needs to consume 25 to 70 per cent more of tomatoes and citrus fruits.

Classification. In the restricted sense of the word, every seed-bearing part of the plant is called fruit, so that some of the vegetables, nuts, and grains should really be classed as fruits. However, the word is usually used to designate those food products commonly classed as fruits and composed largely of water, acids, and small amounts of carbohydrates, mainly in the form of sugar.

Apples, pears, and quinces are classed as pomes; plums, peaches, apricots, cherries, and nectarines as drupes; oranges, lemons, limes, grapefruit, kumquats, and tangerines as citrus; grapes as winefruits; berries as small fruits; and most of the remaining fruits, such as avocado, banana, pineapple, melons, papaya, and persimmons, simply as miscellaneous.

Some Unusual Fruits. Fruits that were known only to natives or travelers in tropical regions are now becoming familiar to many, especially city dwellers, because of improved refrigeration. Foremost among these is the avocado or alligator pear, known to the sailors of the South Seas as "midshipmen's butter." It is a fruit, vegetable, and nut combined. It is pear shaped and greenish brown and has a pulp with the texture of cream cheese. It has a large pit and has a fine flavor because of the high percentage of fat which carries vitamin A. The avocado is used alone in a salad or is combined with other fruits. It contains 10 per cent fat, 3 per cent protein, and 5 per cent carbohydrate.

Other more unusual fruits include the following. Breadfruit has a thick rind, and the pulp resembles bread dough. It is rich in starch and has a flavor much like sweet potato. It is good either baked or boiled. Guava is red or yellow and shaped like a pear. A taste must be cultivated in order for one to enjoy guava. Many know it in the form of paste or jelly. Loquat, raised now in California, is yellow or red, somewhat larger than a plum, and is known in the form of jelly. Mango is a form of melon made into jelly or jam when ripe and pickled when green and is now appearing on the market in frozen form.

Papayas, large, oblong, yellowish, tropical fruits, contain papain, called a vegetable pepsin, which has been used in the tenderizing of meat. The juice of papayas is now on the market. When ripe, they are used as breakfast fruit in the tropics. The unripe fruit may be cooked much as summer squash.

Plantain belongs to the banana family but is larger and coarser and requires cooking. Pomegranate is as large as an apple and has a fine flavor but, owing to the large number of seeds, is a task to eat. It is often made into sirup.

Persimmon, the size of a large peach, is yellow or orange in color and is delicious when mature. If it is picked before it is ripe, it is very astringent and puckers the inside of the mouth. Tangelo, a cross between an orange and a grapefruit, is very common in Florida and is used like an orange.

Artificial Ripening and Coloring of Fruits. Since fruits not fully ripe keep better and can be transported more easily, a tendency has developed, in the cultivation and marketing of fruit, to harvest it before completely ripened and to ripen it artificially. Ethylene gas, used to bring about the ripening, pro-

duces changes in color, composition, and texture which are identical with the natural ripening process. It is thought that the gas catalyzes natural changes in some way similar to the effect of the natural enzymes and tannins.

Gas may affect the color in all fruits but its effect on the composition and texture varies with different fruits. The action seems to be that of the destruction of chlorophyll (green color) so that the yellow pigments (carotinoid) and red pigments (anthocyanins) that are unaffected by the ethylene become visible. The actual ripening of bananas is accelerated by ethylene with resulting changes in texture and mellowness, and formation of sugar from starch. Tomatoes also redden more rapidly. On the other hand, apple ripening is not effected, and in the cantaloupe, although changes occur in color at the surface, the flesh and flavor remain unchanged. While it does not appear that vitamin content is injured by ethylene gas, fruits and tomatoes ripened on the tree and vines have the maximum development of vitamins. Nor does ethylene accelerate the rate of development of vitamin C in tomatoes ripened after picking.

It is interesting to note that, previous to commercial use of ethylene gas for ripening purposes, yellow color was produced by fumes from smoking oil stoves in ripening houses where fruit was stored. With the discovery that the fumes contained ethylene gas, which is also given off by stored fruits and vegetables as well as bruised ones, the use of pure gas developed commercially and has the advantage of permitting longer ripening on the tree. No evidence seems to exist of any harmful health effects from the use of ethylene gas.

Certain citrus fruits, notably oranges, are dyed to change the color only. Fruit which is treated in this way is required by the Federal Food and Drug Administration to be labeled. The coloring is harmless and the process does not destroy vitamin content. It is considered objectionable by some persons since it might be possible to color fruit which is undesirable in some other way. The color of the skin is no criterion for ripeness.

Composition and Nutritive Value. *Nutritive Properties.* Fruits vary in their calorie and protein value and are lacking in fat, with the exception of the avocado and olive. They are chiefly significant as a source of minerals and vitamins in the diet. In some countries such fruits as the banana, coconuts,

dates, and figs are depended upon for considerable energy. As a class fruits are low in calcium, although individual fruits, as oranges, figs, lemons, and grapefruit, may contain appreciable amounts; fruits also contribute to the iron in the diet, dried ones (with the exception of raisins) being especially good. Fruits are poor in vitamins A and D (with the exception of yellow fruits, which have vitamin A) but they are fair sources of both thiamin and riboflavin. Uncooked fruits are excellent sources of vitamin C, although storage may affect the content to a certain extent. Citrus fruits are so notably rich in ascorbic acid that they are a daily nutritional "must" in the dietary, but apples, bananas, strawberries, and watermelon in season are valuable also because of the amount of these fruits consumed. Certain fruits, like apricots, peaches, prunes, and possibly pineapple, appear to possess some specific value (not because of the iron) in the regeneration of hemoglobin.

Fruits contain organic acids, usually in the form of acid salts of calcium, sodium, and potassium. These acids may be oxidized and leave a basic residue in the blood. For this reason, fruits assist in maintaining the acid-base balance of the blood or in keeping it near a neutral point. Relatively large quantities of fruit juices can be oxidized by the body and leave this alkaline residue. These acids include citric found in the citrus fruits, cherries, currants, and strawberries; malic found in the citrus fruits and also in apples, berries, currants, cherries, pineapples, and tomatoes; tartaric in grapes and pineapples; oxalic in minute amounts in many fruits and larger amounts in spinach, rhubarb, and beet greens; and benzoic acid in prunes, plums, and cranberries. The first two are easily oxidized by the body; the third is changed by bacterial activity in the intestine; the fourth is oxidized with difficulty, if at all; the last is not oxidized by the body but converted to hippuric acid and eliminated in the urine.

Dried fruits contain the same food value as the fresh fruits, with the possible exception of the vitamins. The methods of drying used and the preparatory treatment, such as sulfuring and lye dipping, have a determining effect upon the final vitamin content. The amount of thiamin appears to be decreased and the amount of vitamin A retained in sulfured fruits; lye dipping causes a loss of vitamin C unless, in the sulfuring, sulfur dioxide

has been absorbed; in sun drying, thiamin is retained and vitamins A and C lost. The protective action of sulfuring is thought to be caused by the fact that the sulfurous acid formed is a reducing agent and prevents the oxidation of the vitamin. Contrary to the popular idea, there is no evidence that sulfured fruits have any harmful effects on the body.

Frozen foods retain their vitamin C well but lose some in the thawing process. For this reason fruits should be eaten before they are completely thawed out. Canned fruits contain all the nutritive value of the fresh product and, if commercially canned, may be higher in ascorbic acid content then the home-canned product.

In addition, fruits are also valuable as aids in digestion and proper intestinal hygiene. The flavor and the mineral salts and organic acids of fruits stimulate the digestive juices, and the cellulose or indigestible fiber aids still further in good hygiene of the digestive tract. Because lack of vitamin C seems to cause many undefined and vague illnesses, it has been said that "one large orange a day keeps the vague ills away."

Place of Fruits in the Diet. The National Food Guide gives prominence to citrus fruits as well as to other fruits in the daily diet. Oranges, grapefruit, or tomatoes should be eaten every day. Contributions of citrus fruit juices to the daily vitamin C requirement of the adult male are shown as follows: 8 ounces of orange juice supply almost twice the daily requirement, 8 ounces of grapefruit juice supply almost 1¼ of the daily requirement, 8 ounces of tomato juice supply 77 per cent of the daily requirement, 8 ounces of pineapple juice supply only 24 per cent of the daily requirement, 8 ounces of grape juice supply only 6 per cent of the daily requirement.

In order to get maximum value from oranges and grapefruit, the whole fruit should be eaten rather than just the juice, as the pulp contains more vitamin C and iron. The outer peel also contains vitamin C and should be used in marmalades and relishes; in grated form, it may be used for flavoring. Tangerines, when available, add vitamin C. Although they are not as rich as oranges and grapefruit in vitamin C, they do have more vitamin A.

When oranges and grapefruit are hard to get, more tomatoes and their juice, raw cabbage, greens, raw green pepper, and

potatoes cooked with the skins should be used. If dried fruits are hard to get, liver, molasses, greens, whole-grain and enriched products, eggs, and potatoes will supply iron. The fact that the nation needs 25 to 70 per cent more tomatoes and citrus fruits shows that the national diet is still shy in vitamin C, which is well supplied by fresh fruits. To meet the lack of fruits in the British diet, more use is made of cabbage, black currants, and rose hips.

Before fruits were appreciated as a rich source of minerals and vitamins, they were never considered for their nutrients, being known deficient in protein, fat, and carbohydrate. They were used, however, when the price was not prohibitive, for their fine flavor, color, and laxative properties. Because of the nature of the cellulose present in them, the roughage was found less irritating to the digestive membrane of many people than that of vegetables. Flavor in fruits is the result of volatile aromatic compounds which are lost during cooking. Tartness is caused by the presence of the free or combined organic acids. Color pigments in fruits are the same as in vegetables, the insoluble yellow and soluble red ones predominating.

Digestibility. Fruits, because of their color, flavor, and appetizing qualities, aid in digestion by stimulating the flow of digestive juices. They also attract a desirable type of bacteria (the fermentative) in the intestinal tract. Because of their cellulose content, they aid in intestinal hygiene and in elimination. When neither underripe nor overripe, fruits are digested easily. The nature and abundance of the cellulose, as well as the acids, in underripe fruits explain the disagreeable manifestations which follow an indulgence in them. In overripe ones, harmful fermentation, which will proceed in the digestive tract and sometimes give rise to serious intestinal disturbances, may have set in.

As was mentioned earlier, citrus fruits are acid outside the body and in the digestive tract. They are not so after absorption and metabolic changes since the acids are burned or oxidized in the tissues, leaving an alkaline residue that helps to preserve the alkalinity of the blood and other fluids. Of all the fruits, only three, prunes, plums, and cranberries, do not act in this way.

Fruit Cookery. For consumption in raw form, fruits should be thoroughly washed to remove any dust and microorganisms.

Spray mixtures used in the orchard are difficult to remove with plain water; they have usually been removed before marketing by dipping into a suitable solution.

Certain fruits discolor when pared and exposed to the air because of the action of oxidases (natural ferments) in the fruit upon the tannin and other compounds. To prevent this, cut fruits may be covered with any fruit juice, pineapple being particularly effective; acids form light-colored compounds with tannin. When sliced apples, peaches, and pears are dipped into a weak solution of salt, they will not discolor readily. A cream of tartar solution is recommended by some to prevent darkening, particularly of bananas. As mentioned earlier, frozen foods should be used before they have been completely defrosted.

The flavors and pleasant odors of fruit are due to the presence of ethereal substances which are so highly volatile that it is almost impossible to prevent their escape in the steam while cooking, a fact which explains the difference in flavor between the cooked and the raw product. Therefore, unless cooking is necessary for the destruction of the enzymes or organisms that cause deterioration, as in preserving, fruits are more palatable in the raw state. Sometimes unripe fruit can be utilized only if cooked; for example, cooking is necessary for green apples and bananas to soften the cellulose, cook the starch, and improve the flavor by the addition of sugar.

Fruits are cooked to lend variety, to improve palatability, and to improve keeping qualities. They vary in cooking qualities with the quantity present and the form of the polysaccharides, cellulose, hemicellulose, protopectin, and pectin. The presence of a calcium pectate seems to have much to do with the softening or cooking-to-pieces characteristics of fruits. Fruits are most frequently made into sauces and compotes although some fruits, like the banana, peach, pineapple, and grapefruit, may be broiled.

In cooking fruits for sauces or compotes in boiling water, the addition of sugar at the beginning or end of the cooking process (and the presence or absence of the cover) determines whether the fruit will remain whole or will lose its original shape. If it is desired that the fruit remain in whole pieces, it is cooked or baked in a sirup and in a covered utensil. The addition of sugar at the beginning of the cooking holds the shape of the product

by decreasing the amount of liquid in the fruit and thus "firming" it. With certain hard fruits, a very short cooking period in water may precede the addition of sugar. In cooking fruits on the top of the stove, rapid boiling should be avoided as it causes the fruit to break up with a resulting loss of the volatile flavoring compounds. If the product is to be strained, adding sugar just before the cooking is finished will be more economical, as less sugar is then required for sweetening. Straining foods while they are hot causes a loss of vitamin C.

Dried fruits are soaked for only a short time in warm water, simmered gently, and the sugar added about five minutes before the product is finished. Adding the sugar at the beginning of the cooking prevents the fruit from becoming tender as it cannot then absorb moisture.

Preservation. The earliest method of keeping fruit for future consumption was, perhaps, by drying. Such dried fruits as apples, apricots, prunes, and peaches are very valuable, especially in low-cost diets. Dates, figs, and raisins will always be popular.

Canning is now a universally accepted way of preserving. Commercial canning has reached such a degree of perfection that many now use the canned product in preference to the fresh. For example, canned grapefruit and juice require no preparation, thus saving time and labor and eliminating waste.

Formerly, only the surplus was used for canning, but now vast amounts of fruit are raised for this purpose. The fact that the factories are as near as possible to the source of supply, thereby permitting canning while the food is absolutely fresh, accounts for the excellent flavor in all good grades of canned fruits. The use of just the right temperature and the removal of the oxygen from the cans before sealing, to insure heating in the absence of air, have resulted in the retention of those vitamins that are known to be injured by oxidation. Much fruit is now being preserved by freezing.

Jellies, Jams, and Marmalades. The use of fruit in these forms is a pleasant way of introducing it into the diet as well as a means of using a surplus from the home garden. If fruit has to be purchased for this purpose, it cannot be said to be economical when sugar, fuel, and labor are taken into consideration, but many prefer the home product to the commercial product.

NUTS

Nuts are usually considered an accessory rather than a part of our diet, but are, by composition and food value, a staple, and are becoming valuable as meat substitutes. Among the most common nuts are almonds, Brazil nuts, coconuts, available usually in the grated or shredded form, chestnuts, walnuts, hickory, and pecans. Botanically, nuts are fruits. The major nut crops are pecans, English walnuts, and almonds. Fresh coconut is imported mostly in the form of copra, the dried coconut meat from which the oil used in margarines is extracted. The pistachio nut is used for color and flavor. The cashew nut is the leading imported nut.

The peanut, which is really a legume, is not only used whole but also in the form of peanut butter, a product manufactured in large quantities. A record crop of peanuts (a billion and a half) was produced in 1940, with one-third of the entire crop going into peanut butter. Yeasted and chunky peanut butter are two new forms on the market. From the peanut is also extracted a clear colorless oil, closely resembling olive oil, which is used in vegetable shortening and margarine; it is good for frying since it does not smoke until it gets very hot and so allows slow cooking. Peanuts contain 26 per cent good quality protein and 40 to 50 per cent fat. They have high staying qualities and are an inexpensive source of thiamin, riboflavin, niacin, and several minerals.

Peanut flour is now on the market after two years of experimental work. It contains four times more protein, eight times more fat, nine times more minerals than white flour, and is an excellent source of the B complex vitamin. In baking, it can be used to replace up to 15 per cent of wheat flour in simple cakes and quick breads without otherwise changing the recipe; in cooking, it can be used as a meat extender, and as a thickening agent for sauces and gravies. It is creamy in color, has a grayish cast, and produces a darker and heavier product. It is already being used by manufacturers in processed foods.

Nutritive Value. Nuts are a concentrated food. The protein content is high but its proportion to calories is low. Starch varies in amount in different nuts, being particularly high in chestnuts and litchi nuts. Fat is present in large amounts, vary-

ing from 50 to 70 per cent, so that nuts furnish many calories. They are poor in calcium, better in phosphorus and iron, poor in vitamins A and C, good in thiamin and riboflavin. Nuts are one of the few foods of vegetable sources with protein of high quality, the protein of some nuts being adequate. Because of their thiamin content, they probably deserve a greater prominence in the diet.

Digestibility. Nuts are highly concentrated, rich in fat, and therefore necessarily slow of digestion. This does not mean that they are not digestible, however. They may be quite completely digestible if given their proper place in the menu rather than a supplementary place on an otherwise adequate one, as is our habit. If combined with foods of a bulky nature or those low in fat and if thoroughly masticated or ground sufficiently, there is no reason why they should not be a wholesome addition to our food supply. Salted nuts may be toyed with between courses but not partaken of too liberally. There is no reason for thinking that the addition of salt increases their digestibility. Nuts in the form of butters are easily digested.

Cooking. Until rather recently, only the chestnut and peanut were subjected to cooking to any extent, and the method used was roasting. Now, many nuts are used in flour mixtures (bread and cake), in stuffing, and in salads. Their use may be somewhat curtailed owing to the difficulty in keeping them; dampness makes the fat rancid, and, when shelled, they are attacked by insects. Chestnuts are used as a vegetable when fresh. Other uses of nuts are in loaves, croquettes, pastries, nut butters and pastes, sandwiches, and ice creams.

QUESTIONS AND ACTIVITIES

1. Why are fruits stressed as protective foods? For what other reasons are they valuable additions to the diet?

2. A good food standard stresses the use of two servings of fruits daily, one of which is citrus (tomatoes eaten as a vegetable may count as one serving). Keep a list of the fruits eaten by your family for a week. Does each member of the family receive two servings daily? If not, suggest ways to increase the use of fruits.

3. Was your three-day diet record adequate in vegetables and fruits? If not, have you made any improvements since that time in the amount of fruit eaten?

4. During the season when oranges are scarce or high-priced, what may be substituted for vitamin C? What precautions need to be heeded in the substitution for this purpose?

5. Make a list of breakfast fruits for one week and a list of fruits and the ways they might be served at other meals.

6. Would it be wise for a person who has been told that he has too much acid in the stomach to consume large quantities of acid fruits? Why? May the person who has a true case of acidosis (too much acid in the blood), if this condition ever occurs, eat citrus fruit juices? Prunes and cranberries? Explain clearly.

7. List the fruits which are good sources of vitamin A, B, C, and G.

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CHAPTER XI

VEGETABLES

Vegetables as an Article of Food. A great transformation has occurred in vegetable production and consumption during the past fifty years. Vegetables are not only more available now but they are also more popular. The American consumer can now purchase garden products the year round because of better and more rapid transportation and because of the great development of our present-day refrigeration. A continuous upward trend in the consumption of a wide variety of vegetables has been taking place in the food habits of the people of the United States since the last war. To a certain degree, this has been caused by a greater recognition of the importance of vegetables in nutrition. Both fruits and vegetables are considered "protective" foods since they make good deficiencies or inadequate amounts of minerals and vitamins in other foods.

Definition and Classification. Strictly speaking, the term vegetables, defined as "plants cultivated for food; or as the edible part or parts of such plants," includes not only those foods we know as vegetables but fruits and possibly cereals as well. In the ordinary sense, however, the word includes potatoes, beans, carrots, etc. For purposes of study and cooking, vegetables are classified as to (1) the part of the plant from which they come (seeds, roots, leaves, flowers, etc.); (2) composition (those composed largely of water, those containing much protein, and those rich in carbohydrates); (3) flavor (mild or strong); (4) color (green, red, yellow, and white); (5) sources of calcium, iron, and vitamin A.

1. Such parts of the plant as seeds, roots, and tubers function as storage organs, taking an inferior part in the life of the plant. The leaves are more important, being made up of actively functioning cells and containing the chlorophyll (green coloring matter). This chlorophyll enables them to use the energy of the sunlight to bring about the union of the carbon dioxide of the

air with the water and minerals from the soil, thus manufacturing the protein, carbohydrate, and fat which the seeds, roots, and tubers store away to be used eventually either for the nourishment of new plant tissue or as food for man.

Root vegetables include beets, carrots, parsnips, rutabagas, sweet potatoes, and turnips. Chives, garlic, leeks, and onions are classed as bulbs. Irish potatoes, Jerusalem artichokes, and yams belong to the group of tubers. Seeds include beans, corn, cowpeas, lentils, and peas. Cucumbers, eggplant, okra, peppers, pumpkins, squash, tomatoes, and melons are the fruit of plants. Flowers include broccoli, cauliflower, and the French artichoke; stems include asparagus, celery, chard, and rhubarb; and dandelion greens, endive, escarole, parsley, water cress, etc., are classed as leafy greens.

2. Vegetables containing more than 70 per cent water are said to be succulent. They are high in water, minerals, and vitamins, contain little starch and protein, and include tomatoes, asparagus, cabbage, celery, cucumbers, and lettuce.

Such starchy vegetables as peas, beans, corn, potatoes, and soybeans contain an important quantity of starch or protein or both with a good supply of minerals but are not as rich in vitamins as the green vegetables are. Carbohydrates are present in the form of starch in ripe seeds, and sugar in the more actively growing parts. Vegetables having a high protein content are legumes: beans, peas, and lentils. Protein in the plant, though it is not complete or adequate as in animal sources, is of value when supplemented by a combination of several plant or animal foods. Fat occurs in plants in very small amounts in the form of olein.

Cellulose exists in varying amounts, depending upon the nature of the plant, its age, and the part which is used. As mentioned before, this substance cannot be digested to any extent in the human organism, but it is of great value in giving a certain amount of bulk to supplement that quality lacking in more concentrated foods.

3. The classification of vegetables into strong- and mild-flavored groups is based on the presence of sulfur compounds in the former. Cabbage, broccoli, Brussels sprouts, turnips and kohlrabi, of the cabbage family, and chives, leeks, onions, and garlic, of the onion family, comprise this group. Sulfur-contain-

ing vegetables might be a better group designation since some are strong in the raw state and lose some flavor during cooking in water, whereas others are mild when raw and develop disagreeable flavors when cooked improperly.

The sulfur compounds are volatile and pass off in the steam during cooking. When the vegetables are over-cooked or cooked at high temperature, hydrogen sulfide and sinigrin are formed, resulting in objectionable flavor and color. Acid hastens this decomposition. Strong vegetables are cooked without a cover to allow the vegetable acids and strong flavor to escape.

4. Classification on the basis of color is possible because of the different types of pigment present in the different vegetables.

Green Vegetables. When plants are grown in the presence of light, the well-known green coloring, chlorophyll, is developed. Though this color is not readily soluble in water, heat (especially high temperature and long cooking) destroys its brightness, as acid does; alkali enhances it, as copper and zinc salts do. All green plants contain chlorophyll, since it is impossible for plants to form carbohydrate without it. Plants grown without light contain no chlorophyll as seen in the case of the white asparagus which is grown away from the light. Although baking soda preserves the greenness, its use is undesirable because of its destructive effect on ascorbic acid and the B vitamins. A relationship exists between chlorophyll and vitamin A.

Red Vegetables. Red and purple vegetables depend for their color on pigments called anthocyanins which do not react to heat but are readily soluble in water. Acid intensifies the red color. Recipes for the preparation of beets and red cabbage usually call for the addition of small amounts of vinegar. Blue plums turn red during cooking when the cell walls are ruptured and the acid comes in contact with the pigment. Alkali causes anthocyanins to become purple. Red cabbage cooked in tap waters of varying alkalinity may show different color hues.

Yellow Vegetables. Yellow vegetables owe their color to pigments called carotinoids which hold their own in water, acids, and alkalis, thus showing great stability. Carotinoids include carotene in carrots, lycopene in tomatoes, and xanthophyll in yellow corn. The apparent change in color, when cooking carrots, is due to the caramelization of the sugar in the carrots and not to any pigment change.

White Vegetables. The whiteness of vegetables is the result of the absence of pigments although they contain flavones that are colorless in acid but become yellow in an alkaline medium. All vegetables probably contain flavones, accounting for the yellow color of the cooking water from some vegetables. If water containing iron salts is used for cooking, it may cause white vegetables to become yellow.

5. Table 26 classifies vegetables as important sources of calcium, iron, and vitamin A.

TABLE 26

VEGETABLES AS IMPORTANT SOURCES OF CALCIUM, IRON, AND VITAMIN A *

Calcium	*Iron*	*Vitamin A*
Broccoli	Beans	Kale
Cabbage	Beet greens	Spinach
Savoy and non-headed	Broccoli leaves	Dandelion
Chinese	Chard	Dock
Chard	Cowpeas	Escarole
Collards	Dandelion	Chard
Cress, garden	Kale	Turnip tops
Kale	Lentils	Collards
Mustard greens	Mustard greens	Water cress
Tendergreens	New Zealand spinach	Chinese cabbage
Turnip tops	Brussels sprouts	Broccoli
Water cress	Cabbage greens	Mustard greens
Artichokes	Collards	Beet greens
Beans	Dock or sorrel	Carrots
Carrots	Endive or escarole	Sweet potatoes
Celeriac	Peas	Yellow squash
Celery	Vegetable oyster or salsify	Sweet peppers
Chickpeas		Green peas
Chicory		Green beans
Endive or escarole		Asparagus
Kohlrabi		Okra
Lettuce		Yellow tomatoes
Okra		

* *Food and Life*, United States Department of Agriculture, Yearbook 1939, compiled from pages 276, 278, and 288.

Legumes. These vegetables come from the pulse family, plants that have the advantage over other plants in that they can utilize the free nitrogen of the air, whereas others are compelled to get theirs from the soil. The edible part is the fruit or seed of the plant, found in pods and known as peas, beans,

and lentils. They may be eaten green or dried. Beans, when eaten with the pod, are the well-known succulent vegetable: string beans, butter beans, etc. In dried form, the navy, kidney, Lima, haricot, and Mexican beans, known as "frijoles," are familiar. Because of their concentrated food value and cheap price, beans are a large part of army and navy rations and low-cost diets.

Peas, like beans, are used in both the green and the dried state. Fresh green peas, especially June peas, are a favorite with many people. Dried peas, except in the diet of vegetarians, usually appear only in split-pea soup. They include black eye, green, and yellow peas.

Lentils are not like the pea, being the shape of a disk. They grow on vines, like the pea, but the pods hold only three or four seeds. Only the dried seeds are used. They are appreciated more by the foreign population, the usual objection to them probably being due to their dark and unattractive color. Served in the form of a purée or thick soup, however, they are often enjoyed.

Soybeans, first grown as forage crops, are now a valuable addition to the list of vegetables in the daily diet. Dry-bean products include flour, "milk," curd, refined oil, and soy sauce; green shelled beans of the garden variety are richer and have a nuttier flavor than other legumes. As a green vegetable, soybeans are shelled or cooked in the pods. When cooked and served in the pods, they may be dipped in butter and eaten with the fingers.

Before beans can be shelled, they must be boiled in the pods for 3 to 5 minutes. United States Department of Agriculture bulletins list the following as desirable garden varieties: Agate, Hahto, Easycook, Rokusun, Funk Delicious, Kanro, Aoda, Bansei, Shiro, Hokkaido, Chusei, Higan, Kura, Willomi, Nanda, and Jogun. The following varieties of dry beans are listed for successful use: Easycook, Chusei, Rokusun, Jogun, Hokkaido, and Kanro as requiring the least cooking, and Mammouth yellow Dixie and Hahto as requiring the most cooking. All dry beans require soaking over night.

Composition and Nutritive Value. With the exception of the starchy vegetables, like potatoes, corn, and beans, vegetables yield but little energy. They also lack fat. The protein content is not considered adequate in either kind or amount,

legumes being the only ones which furnish even appreciable amounts. As a group they are valuable for their cellulose content, minerals, vitamins, and base-forming properties. Leaves and stems are especially valuable for calcium, and leafy, other green, and yellow vegetables for vitamin A. Aside from these values, vegetables have certain esthetic appeal because they are colorful, palatable, good in texture if raw or properly cooked, and refreshing, and give variety and interest to the diet.

Special mention needs to be made of the green leafy vegetables, as they are better for certain minerals and vitamins than other parts of the plant. They are especially valuable for calcium, iron, and vitamin A; young leaves are high in vitamin C and riboflavin. Vegetables classed under this heading include the more familiar dandelion, lettuce, kale, endive, chicory, spinach, parsley, romaine, cress, turnip, beet and radish tops, mustard greens, and the less familiar wild greens that may be had for the picking, such as lamb's quarters (also known as pigweed, wild spinach, or goosefoot), plantain, poke, purslane, dock, milkweed, cowslip, and sorrel. A list of wild greens native to the state may be secured from the home economics extension service of the state college.

As cooking cannot here be relied upon to destroy microorganisms, the greatest care must be exercised in cleaning greens, and ice water must be used to preserve their crispness. Long soaking of the greens, however, is not desirable. When the cellulose is young and tender, even though it in itself is not digested, the liberation of valuable juices takes place and the residue not attacked by digestive ferments promotes friction along the walls of the large intestine, resulting in easy elimination.

Stems resemble leaves in nutritive value; the greener they are the more vitamin A they contain. Seed vegetables, as corn, peas, and beans, are high in protein although of an inadequate type. Green peas are high in ascorbic acid, and both peas and beans are high in thiamin, riboflavin, phosphorus, and iron.

The potato needs special mention because of the considerable amounts of vitamin C and iron it contributes to the diet if it is properly cooked and because of the amounts consumed under normal circumstances.

Vegetables, being composed so largely of water and cellulose, are invaluable where it is desired to increase the mineral and

vitamin intake without further increase in protein or fuel foods and may be used to give bulk to an otherwise concentrated diet.

Legumes are high in protein, coming nearest to meat, eggs, milk, and cheese as body builders. They are rich in starch but deficient in fat; minerals, especially iron and phosphorus, are present in appreciable amounts, as is thiamin. Despite their high protein content, they are base-forming rather than acid-forming foods.

Soybeans are higher in food value than other beans, because they are richer in protein and fat, the protein being more utilizable by the body. They contain one and one-half times as much protein and twelve times as much fat as other kinds, even in the green-shelled state. Carbohydrate is lower, about one-half the amount of that in other beans. As some carbohydrate is not well utilized, only about 12 per cent is available in the dry state and 6 per cent in the shelled.

Fresh or dry soybeans are good sources of calcium, phosphorus, and iron; fresh green (especially darker varieties), are rich in vitamin A and a good source of thiamin and riboflavin. Dry beans appear to be good sources of thiamin and riboflavin, poorer in vitamin A, and only a fair source of niacin. They contain no vitamin C until sprouted, when they provide an excellent source of vitamin C. Sprouts are, in addition, good for calcium and protein. Soybean grits are also on the market.

The food value of soybean flours and meals, if made from whole soybeans, is similar to that of the dry beans. Soybean curd, long popular with Oriental peoples, contains 85 per cent water, 8 per cent protein, 4 per cent fat, and fewer minerals than the dry beans, as some are lost when the coagulation is brought about by acid. Soybean "milk" contains only one-sixth as much calcium, two-thirds as much protein, and one-third as much fat as fresh cow's milk, no sugar, and little vitamin A; the protein is less effectively used than that of cow's milk.

Place in the Diet. The daily diet should contain at least one serving of potatoes, preferably cooked with the jackets, and two or more servings of other vegetables, one of which is a leafy green or yellow. Raw vegetables should be consumed at least three times weekly, if not oftener. Vegetables are an important war food as they supply many of the minerals and vitamins apt to be lacking because of the scarcity of butter, meats, and citrus

fruits. In a scarcity of vitamin A, more greens, yellow vegetables, and tomatoes are necessary; in a citrus fruit shortage, more raw cabbage, turnips, green pepper, beet and turnip tops, and potatoes in the jackets are needed; in a meat shortage, green vegetables, tomatoes, and dried peas and beans will add the B vitamins to the diet; iron, lacking because of meat scarcity, will be furnished by green leafy vegetables, dried beans, and lentils. Recent dietary studies have revealed that the nation needs to consume twice as much leafy, green, and yellow vegetables for good nutrition.

As mentioned earlier, vegetables are filling, without too many calories, and provide satiety value to the diet as well as appetite appeal. The art of vegetable cookery needs to be more carefully developed if vegetables are to be enjoyed and are to maintain their rightful place in the dietary. All vegetables have important contributions to a nutritious diet at the low-cost level. One-half cup of green leafy vegetables supplies from 8 to 26 per cent of the total daily requirement for calcium, from 18 to 30 per cent of iron, and from 200 to 400 per cent of vitamin A.

Vegetables may be served in innumerable ways. The salad bowl adds greatly to any meal and utilizes the nutritious leafy vegetables. Vegetables may be prepared in many other ways: buttered, scalloped, baked, fried, casserole dishes, soufflés, croquettes, in soup, and in jellied combinations.

Legumes have an important place in the weekly dietary as main dishes in place of meat; they are especially important on the low-cost diet. They can well be featured more often at all diet levels because of their food value and also because they are more abundant than most wartime foods. Soybeans are the nearest approach in the vegetable kingdom to the efficient protein of animal products, a reason why the people of the Orient have fared so well without more meat, egg, and other animal protein food in the diet. Soybean products are valuable for stretching meat rations. In one state, the state emergency food committee has recommended that some canning-factory facilities be devoted to the sprouting of soybeans.

Digestibility. Vegetable foods, though neither as easily nor as completely digested as animal food (freshness and manner of cooking will affect digestibility to some extent), are well handled by the body. The sulfur compounds found in some of the

strong vegetables often decompose during the process of cooking, resulting in the formation of hydrogen sulfide gas, which accounts for the flatulence and general discomfort experienced by many persons after a too liberal use of these vegetables in the diet. Proper cooking of these vegetables is important for good digestion.

Attractiveness and palatability of well-prepared vegetables probably have much to do with the stimulation of the digestive juices, thereby facilitating digestion. Improved intestinal hygiene is brought about by the amount of cellulose present in the vegetables as well as by the fact that vegetables, like fruits, alter the bacterial action in the intestine by promoting the growth of desirable fermentative bacteria. Uncooked vegetables are probably not quite as completely digested as cooked ones and their excessive use may lead to digestive disturbances.

Legumes, particularly in the dried state, are neither quickly nor completely digested by the majority of people. This may be due to the substance, called "hemicellulose," which is present in them and which is prone to ferment in the intestines and give rise to objectionable gases. The theory is held by some that this gas helps to break up solid masses of refuse in the large intestine and so is an aid in constipation.

Selection of Vegetables. The old idea that only such vegetables as are in season should be chosen no longer holds in face of the fact that nearly all fresh vegetables seem to be procurable all the year round, especially in large cities. This, of course, is due to the greatly improved methods of refrigeration and transportation by which these foods are brought from great distances.

The indications of good quality in all vegetables, in general as well as specifically, are many, but the outstanding ones are firmness, freedom from bruises, and crispness. Wilting indicates that vegetables have stood long enough to lose water by evaporation and are far from fresh. All should be heavy in proportion to their size, and medium-sized ones are preferred to the very large, which are apt to be fibrous. Those vegetables that are uniform in size make for facility in cooking.

The amount of waste needs to be considered and is less in vegetables in good condition, of high quality, and uniform shape. It is best, when possible, to buy near the sources of supply and, when storage space is limited, to purchase in small

amounts to insure freshness. Most vegetables are better if used as soon as possible after purchase. The majority of vegetables do not store well and storing causes a decrease in vitamin C. A cool place in which the air circulates freely should be chosen for storage, and perishable and semi-perishable vegetables should be refrigerated.

United States government grades for fresh vegetables include U. S. Fancy, U. S. No. 1, and U. S. No. 2. Since these grades apply to the wholesale buying of vegetables, they are not of too much value to the consumer. The retailer may purchase by grade but does not usually sell to the consumer by grade. The qualities upon which federal standards are based might be used as buying guides by the consumer for the individual vegetables. Copies of these standards are available from the United States Department of Agriculture. Frequently, state departments of agriculture issue vegetable-buying guides.

Vegetable Cookery. A number of vegetables low in starch lend themselves well to being served raw. For the majority of vegetables, however, cooking is necessary to make them more palatable and digestible by softening the cellulose and cooking the starch. Thorough washing is necessary before eating vegetables raw; after washing, they should be refrigerated or placed in ice water. Long soaking causes loss of food value.

Effects of Cooking. Color, texture, flavor, nutritive value, and digestibility are affected during the cooking of vegetables. Vegetables normally contain an acid which is volatile and is liberated from the cells during the cooking process. If it is not allowed to escape, it comes in contact with the vegetables, destroys the green color, intensifies the red, protects the white, and has no effect upon the carotene. The medium in which the vegetable is cooked may be kept alkaline by cooking uncovered so that the volatile acid may escape. The maximum color in green vegetables and a desirable flavor in the strong ones will be assured if the cooking utensil is left uncovered during boiling. This will allow the volatile acids, which cause chlorophyll, to change color, to escape (in the case of the green color), and to allow some of the objectionable flavor (in the case of the strong vegetables) to volatilize. Other vegetables may be boiled with the cover on. Some persons believe that green vegetables retain

their color better if cooked covered. Covering the pan reduces the time of cooking.

During cooking, the cellulose is softened and may be made soluble. Cooking also separates the cells and makes for greater digestibility. Rapid boiling causes the vegetables to break up and continued cooking causes them to get mushy, decreasing the palatability and allowing more food value to dissolve in the cooking water. Such things as the hardness of the water and the addition of baking soda may also affect the texture. In cooking dried beans, hard water may prevent the beans from becoming tender but baking soda aids in the tenderizing. It is thought by some that the addition of salt at the beginning or half way through the cooking of vegetables produces a better texture. The use of baking soda to keep the color of green vegetables is undesirable both because of its effect on the vitamins and also because it causes vegetables to become mushy, allowing a greater loss of nutritive value.

Flavor of vegetables is modified by cooking. In the case of strong vegetables, acid makes the sulfur compounds less stable, resulting in undesirable flavors in the cooked product. This is especially true of overcooked foods.

Nutritive value may be affected by the cooking process. Minerals, water soluble vitamins, and sugar are dissolved into the cooking water, and, unless the water is used, this food value is lost. Actual destruction of some of the vitamins, especially vitamin C, may occur, although less is lost in an acid medium than otherwise. High temperatures are destructive of vitamins although a very short time at a very high temperature may be less destructive than a long time at a lower temperature.

Long, slow cooking methods, like stewing, simmering, and baking, cause a greater loss of vitamins than short cooking. Frying, also, is destructive of vitamins; steaming and short-time boiling methods preserve more of the vitamin content.

Since vegetables are cooked in their own juice when steamed, this method will insure a greater retention of the soluble minerals and vitamins. From the standpoint of color in the green and flavor in the strong vegetables, this procedure is probably not the best, as the acids do not volatilize and the more objectionable flavor remains in the latter.

Quick cooking will aid in the retention of vitamin C as well as make for a better texture in all vegetables and a better flavor in strong vegetables by preventing the decomposition of the sulfur compounds. Salt is usually added near the end of the cooking process. The use of baking soda for the purpose of shortening the time required for cooking or for preserving the color in the green vegetables is not recommended because of its undesirable effects upon vitamins B and C.

Cooking makes some of the constituents in vegetables more digestible. Cells are separated, starch swells (some becoming soluble), the protein coagulates, and cellulose softens. The usual methods used in the cooking of vegetables include boiling, steaming, and baking. Although boiling is considered least economical from the nutritive standpoint, it need not be if certain precautions are followed. Greater retention of food value will result when the following procedures are carried out: (1) boil with the skins on wherever possible or, if necessary to pare, cook vegetables whole whenever feasible; (2) when it is necessary to cut, do so with the grain rather than across the grain; (3) start to cook in the smallest possible amount of boiling water; (4) cook just until tender; and (5) utilize the water left in the utensil in the making of soup or sauce.

The recent availability of the small pressure cooker for cooking vegetables in the home has raised the question as to the effect of the high temperature, secured under pressure, on the vitamin content of the food. Experimental work is in progress to answer this question scientifically. To date, it appears that the very short time of cooking at the higher temperature may be no more destructive to the vitamin content than the longer time of cooking at the lower temperatures.

Preservation. Unquestionably, all vegetables are at their best when cooked directly after picking, especially the succulent ones. On the other hand, many roots, tubers, and seeds are little affected by storage if the temperature to which they are subjected is sufficiently low to suspend the action of enzymes which, in some vegetables (for example, parsnips), transform the sugar into starch, and in others, the starch into sugar, as evidenced by the waxiness and sweetness of a frozen white potato.

Such preservative methods as packing fresh vegetables in salt or storing such so-called winter ones as cabbage and onions in a

cool place are still practiced in a small way to conserve the garden surplus, but home canning now seems to replace all other methods. Canning done on a scientifically large scale in the big canning industries conserves the flavor and nutritional constituents of these products. The popularity of many canned foods, especially vegetables and tomato juice, is ample proof of this. The old habit of discarding the liquid from canned vegetables is to be deplored; in that liquid are soluble nutriments and flavor.

Canned vegetables and fruits are available in large quantities. The people of the United States consume more canned foods than the people of any other country. The difference in flavor between fresh and canned foods is a limiting factor to some persons, but canned foods, especially commercially canned ones, compare favorably with fresh products in nutritive value.

A wider variety of frozen vegetables than fruits is available. The preparatory treatment given vegetables before freezing may cause some loss in food value, but the freezing process itself causes no further loss. Vitamin C is lost during the thawing process so frozen vegetables are started to cook in the frozen state.

Although commercial food drying is an important food industry, the drying of vegetables (with the exception of peas and beans) is not done so extensively as that of fruits as there seems to be less demand for these products. Dehydrated and evaporated vegetables are available. Dehydrated vegetables are fresh or green vegetables from which the moisture has been removed; examples are tomatoes, spinach, corn, and potatoes. Evaporated vegetables have matured naturally; examples are peas and beans. At the present time, because of the war effort, much research is being done on dehydrated foods, and it is expected that these foods will be more important in the American dietary after the war.

QUESTIONS AND ACTIVITIES

1. A good food standard tells us that three vegetables, one of which is potatoes, should be eaten daily. Keep a list of vegetables eaten daily by your family for one week. Does the list meet the above requirements? If not, what suggestions can you make for including more vegetables in the diet? A second serving of the same vegetable may count as one of the three required.

2. What vegetables are ordinarily eaten raw? What are the advantages of using vegetables in this form? List all the different ways

they may be served raw. How many of the vegetables on the list compiled in 1 above were eaten raw?

3. Explain the reasons for the inclusion of vegetables on the list of protective foods.

4. The proper cooking of vegetables is necessary for the full retention of their mineral and vitamin value. List all the things to do and all the things not to do in their cooking for the complete retention of these qualities.

5. For palatability and enjoyment of vegetables, retention of color is also an important requirement in cooking. List the best method for cooking green, yellow, red, and white vegetables to retain their original color and at the same time to preserve the food value.

6. How can the water left from the cooking of vegetables be utilized? Are there any advantages in so doing? Should the liquid from canned vegetables be discarded? Why?

7. Classify all green, yellow, red, white, and miscellaneous vegetables as mild or strong (or gas-forming). List ten combinations of four vegetables each, using one of each color but not more than one strong or gas-forming one in each combination.

8. Look up in your cookbook different ways of serving each of the above vegetables listed.

9. What suggestions would you make to the person who tells you that he does not like vegetables generally? Specific vegetables?

10. Using graph paper, show the contributions of servings of several vegetables. This graphic representation may be done in shares or percentages (see pages 113–116).

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CHAPTER XII

CEREALS AND CEREAL PRODUCTS

Foods High in Carbohydrate. The most economical and available sources of energy are those foods which predominate in carbohydrates. These carbohydrates are either sugars, the monosaccharides or disaccharides, or starches, belonging to the polysaccharides. Foods rich in sugar are the purified sugars, sirups, molasses, candies, jams, jellies, marmalades, etc. Fruits also contain sugar. Sugars and other sweets will be considered in a later chapter.

Foods high in starch include such cereal grains as wheat, oats, corn, rice, rye, barley, buckwheat and their flours, breakfast foods, macaroni products, and flour mixtures (batters and doughs) of various kinds.

Starch. One of the most important of the polysaccharides is starch, which is a substance thought to be manufactured from simple sugars by the plant. It is valuable not only as a food substance but also as a source of dextrin, commercial glucose, and other products.

Sources of Starch. Starch is the form in which plants store their food for future consumption, the storage points being the roots, seeds, fruits, and stem. Although starch occurs in a great many plants, most of the starch of commerce comes from wheat, corn, rice, potatoes, arrowroot, and cassava. Starch examined under the microscope appears in the form of tiny grains or granules, the walls of which are composed of cellulose. Two or more substances are found in the starch granule, a soluble portion called amylose and an insoluble portion called amylo-pectin. This latter portion is credited with the gel-forming properties of starch.

Grains differ in size and shape according to the source from which they come. The grains of potato starch are relatively large, being one-hundredth of an inch in diameter and shaped like a kidney bean, whereas the wheat grain is only one-thousandth of an inch in diameter.

When absolutely free from moisture, starch stays in good condition indefinitely, but the fermentation of moist starch can very easily be brought about by yeasts and certain other organisms.

Less Familiar Forms of Starch. Tapioca, sago (or palm starch), and arrowroot are forms of starch less commonly used. Tapioca is derived from starch of the root or tuber of cassava or manioc, native to South America. This starch, known as a tapioca flour, is made into a dough which is either forced through a sieve to give the familiar pearl tapioca or baked in a thin sheet, called flakes, which are finally ground to produce the granular or new "minute" form. Sago or palm starch is made from the pith of the sago palm. Arrowroot is obtained from the roots of the tropical arrowroot plant of the West Indies. Potato starch and rice flour are also available.

Food Value of Starch. Starch from different sources forms a very large part of the diet of most people and is the most economical and abundant source of energy. Because starch in its natural state is not soluble (one reason why it can be stored by the plant while it sojourns in the damp earth), it cannot be made available to the body until it is chemically changed. This change is brought about during the process of digestion by the action of certain enzymes occurring in the saliva and the pancreatic and intestinal juices. The result of this action is to convert the starch first into dextrin, then into maltose, and finally into glucose, in which form it is absorbed into the blood stream. The ease with which these changes are brought about depends somewhat upon the sources of the starch and the thoroughness of cooking. If the starch remains enclosed in its cellulose covering, longer cooking is called for.

Functions of Starch in the Body. While the chief function of starch in the body is to yield energy, it also appears in small quantities as part of the nucleoprotein in the protoplasm. Because of its non-stimulating and colloidal nature, it serves to protect the delicate walls of the intestines from the action of irritating crystalloids. The body seems to show a decided preference for starch as a source of energy. The end products of its digestion and metabolism put very little strain upon the organs of elimination as they can be easily taken care of. If more starch is eaten than the body can use at one time, it can be stored by

the liver in the form of glycogen for future consumption; great excesses are converted into fat.

Cooking of Starch. Starch is insoluble in water but, if the water is heated, it will be absorbed by the starch grain, which swells and becomes viscous and translucent; or gelatination takes place with moist heat. Continuous boiling of starch mixtures does not appear necessary, but boiling for a few minutes before completing the cooking in a double boiler appears to be advantageous. As acids hydrolyze starch and interfere with their thickening properties, such substances as fruit juices and vinegar are added to starch mixtures after thickening has occurred. Dry heat converts starch into dextrin, which is brownish in color and soluble in water. This is familiar, in bread crust and toasted bread, to most people.

It is generally agreed that longer cooking improves the flavor of starch, but the very long time usually advocated for starch cooking does not seem to be justified on this basis. To insure a smooth, starchy mixture when using hot liquids, the starch needs to be separated by some agent before the hot liquid is added. In the case of puddings, it is the sugar and in white sauce or gravies, the fat; or it may be simply done by mixing the starch into a paste with cold water.

Digestibility. It was once thought that raw or partially cooked starch could not be digested. This idea seems now to be without foundation. It is true that the rate of digestion is speeded up when starch is cooked. Some of the commercial processes to which cereals are subjected before marketing help to make the cereal starch more digestible. It is essential that the cell holding the starch granules be ruptured so that the digestive juices are able to mingle with the starch to start their action. The idea formerly held that long cooking is necessary for complete digestion appears to be unfounded since experimental work showed that certain cereals cooked over half an hour were no more digestible than those cooked for only half an hour.

Other Polysaccharides. *Cellulose.* Cellulose is the substance out of which the framework of the plant is built. Though classed with starch as one of the polysaccharides, it has no food value because the body is supplied with no enzymes that can digest it. The increased difficulty found in digesting vegetable foods, as compared with animal foods, is attributed to the pres-

ence of cellulose, which, by enclosing the nutrients in its fibrous envelope, prevents free access of digestive juices. The amount and nature of this cellulose differ in different parts of the plant and at different stages of growth. In young plants it may be quite tender, but in the older plant the cell walls show a tendency to thicken and toughen, owing to an increase of cellulose and a decrease of water. Its chief value to the human organism is to give bulk to the food and to stimulate peristaltic action in the intestine. Cellulose is insoluble in any liquid other than strong acids and alkalis.

Glycogen. Glycogen, usually called animal starch, is formed in the liver from glucose and is stored there as well as in the muscles. It is found in the edible fungi and other plants that have no chlorophyll; shell fish, especially oysters, contain as much as 9 per cent. Commercially, it is a white powder extracted from liver and soluble in water.

Pectins. The complex substances belonging to this group possess the property of converting fruit juices into jellies. They are compounds of galactose, a monosaccharide.

CEREALS

Cereals as a Food Article. This group of foods derives its name from Ceres, an ancient Greek goddess who was protectress of the grains and harvest. It includes all grains and cultivated grasses whose seeds are used for food, such as wheat, oats, corn, rice, rye, barley, and buckwheat, and the products from these grains.

Cereals and their products are used more largely throughout the world than any other type of food. The consumption of bread and flour has decreased in the United States during the past fifty years because they have been replaced by other foods and because the need for total calories has decreased along with the changes in the way of living. However, studies by Stiebeling and Phipard, in 1939, of 4,000 family food records showed that in all regions, regardless of the level of expenditure for food, the largest share of calories was derived from grain products. Approximately one-third of the total calories consumed in the United States and Great Britain come from cereal products, more in Europe, and still more in Asia. It has been estimated that

rice is the chief article of diet in one-half the world. In this country, corn is the staple food article of the southern Negroes.

Structure of Cereal Grains. Each cereal grain has specific characteristics, but, because of general similarities between them

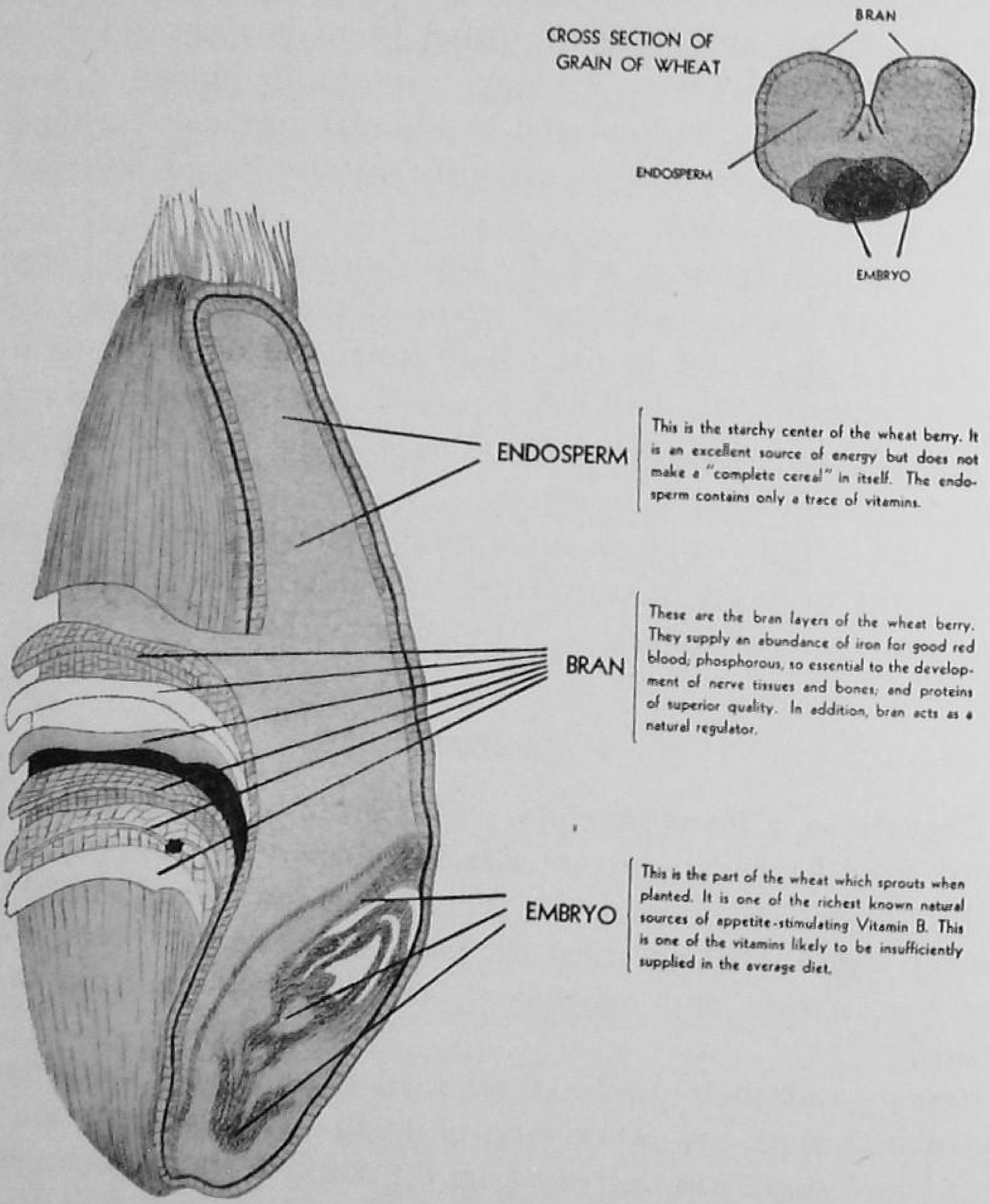

FIG. 26. Diagram of a grain of wheat. Courtesy, Ralston Purina Company, St. Louis, Missouri.

in structure, the wheat kernel is usually taken as typical. All cereal grains have several parts but the following are common to all. The outside portion, acting as a protective coating, is composed of several bran layers, containing cellulose, minerals, protein, and small amounts of thiamin. Within these bran layers is the central portion or endosperm, the storehouse of

the grain, containing the starch, protein, and, at one end, the germ or embryonic plant containing fat, minerals, and vitamins B, G, and E. The different parts of a cereal grain are shown in the kernel of wheat in Figure 26.

Grains Used as Food. *Forms in Which Used.* In general, cereals are consumed in two forms, the whole grain and refined. If the cereal grain is left practically intact, with the possible exception of the removal of the outermost bran layer or husk, it is known as whole grain. If the bran layers, in whole or in part, and the germ are removed in the milling process, leaving only the starchy portion, it is known as refined. Whole-grain products are available in the whole form, crushed, rolled, and ground. These are more complete in food value than the refined ones. Products made from only the bran layers are equally incomplete in food value.

Most of the above types of cereals belong to the group requiring cooking before consumption. Ready-to-eat or prepared cereals are available in a number of forms, such as puffed, shredded, flaked, and malted. Some of either the uncooked or prepared cereals may have been irradiated to increase the vitamin D content or otherwise treated to increase vitamin value.

Wheat. Wheat has always been one of the most universally used of all cereals. This can be accounted for by its superior gluten content, which permits its being made into a palatable bread. Many preparations of wheat are to be found on the market. In addition to whole-wheat (graham) or white flour, breakfast foods include those in which the kernels are finely ground, yielding such products as Wheatena, Cream of Wheat or Farina, and Cracked Wheat, Pettijohns, Shredded Wheat, and Puffed Wheat, in which the kernels are treated in a different manner.

Another form or part of wheat coming into use and popularity is the germ or embryo portion, wheat germ. It is available in granular or flaked form, toasted or untoasted, marketed under commercial trade names, or obtainable directly from the flour mill. That obtained from the mill is least expensive. Commercial products are treated so as to retain vitamin content and to keep better. Wheat germ is an excellent source of the B complex vitamins.

The sprouting of wheat grains is a quick and inexpensive way to obtain vitamin C. Sprouts may be obtained in a week or two by placing good quality wheat grains on a fine-meshed screen over a pan of water and covering lightly with a piece of damp cheesecloth.

Wheat is the most popular grain in this country and is second only to rice in the amount consumed throughout the entire world. Besides the bread and pastry flours and breakfast foods made from it, such products as macaroni, in all its different forms, are extensively used.

Macaroni Products. These products, also known in the form of spaghetti, vermicelli, noodles, and Italian paste, all of which are called alimentary pastes, are made from a special variety of wheat known as durum, which is particularly rich in gluten. The coarse flour (semolina) from this wheat is made into a stiff dough which is kneaded, then drawn out, molded or stamped (into various shapes and forms), dried in the sun, cured, hung for 12 hours in the dark, and finally redried in the open air or in a room in which a current of air circulates. The yellow color of these products may be due to the color of the strains of wheat used or to the addition of eggs to the mixture. For some European countries, macaroni products may be as important as bread is to the people in the United States.

Oats. This cereal has the largest amount of fat of any of the cereals, usually varying from 2 to 7 per cent, and is the main cereal crop of Great Britain. In preparation, only the outside husk is removed, so oatmeal preparations are considered whole grain in nature. Oatmeal cereal products include the steel-cut variety, in which the grains are cut by special cutting machines, and the scotch oatmeal, which is ground. To produce rolled oats, the form in which the cereal is most commonly used in this country, the grains are steamed and rolled instead of being ground and dried. The semi-cooked or quick-cook rolled oats are popular although the longer-cooking variety is preferred by some. Oat flour is unsatisfactory for making bread because of its lack of gluten. Commercially it has been used as an anti-oxidant in fats to prevent rancidity. Recently there has appeared in the market a ready-to-eat puffed oatmeal product.

Corn. Corn is used as a vegetable and also as a breakfast food in the form of cornflakes, puffed, grits, and meal. Puffed and

flaked varieties are ready to eat; hominy, also known as coarse pearl hominy or samp, is the dry corn grain with hull and germ removed. It may also be used in the finely ground form called hominy grits.

Cornmeal is produced by both the old and new process methods. In the former, the product is obtained by grinding the whole grain, without bolting it, to remove the bran and germ. In the latter, the bran and germ are removed, thus lowering the food value. Though not suitable for bread, unless combined with wheat, the meal can be used for hot breads which are baked in small pans or tins. Yellow and white cornmeal are used in the preparation of cornmeal dishes. Yellow has a higher vitamin A value than white.

Corn flour is made by milling white cornmeal and is used in commercial flour mixes. Corn oil is produced from the germ and is used alone or in combination with other oils for cooking purposes. Cornstarch is made from the endosperm, and recently corn sugar (commercially called cerelose) has become available on the market.

Rice. Rice forms the staple article of diet for one-half the population of the world. It has the highest percentage of starch, which occurs in small, easily digested granules, but it is the poorest in fat and protein of all the cereals. In whole-grain form, with only the husk removed, it is known as brown rice. The polishing of rice, by which the outer coating and germ are removed, is thought to improve its appearance, but it greatly decreases its nutritive value. Some polished rice is treated with a glucose and talc mixture to give it a shiny appearance and is called "coated" rice. Rice is graded according to wholeness of the grain into head and broken rice and screenings.

As a breakfast food, rice is available in uncooked form as brown and white; in ready-to-eat form, as puffed crispies. Rice polishings are also available much as the wheat germ is, and they constitute a good source of vitamin B. Rice flour is available but is not usable for bread, only for small cakes. Rice starch is used commercially.

Wild rice is really not rice at all but the seed of a wildly growing grass in the Great Lakes section. It is thought to be of greater food value than even the brown rice but its scarcity and high price limit its general consumption.

Rye. Rye, like wheat, contains gluten in the proper proportions to produce a bread of the proper texture, and this is about the only way this grain finds favor as a food. Also a cracker product utilizes rye flour in its production.

Buckwheat. Although not actually a cereal, buckwheat is usually included with this group of foods. This grain produces a dark-colored flour containing enough gluten to permit its being used in the making of pancakes.

Barley. Barley is available in the pearl and flour form as well as in malted form in some breakfast foods. Malted barley is produced by sprouting the barley grain to cause the formation of an enzyme called diastase, which, in turn, changes starch to maltose. In this form it is used in making yeast and fermented beverages.

Composition and Nutritive Value of Cereals. Breakfast cereals contain approximately 66 to 80 per cent carbohydrate, 8 to 12 per cent protein, and 0.3 to 2.0 per cent fat; they average 1,600 calories per pound or about 100 calories per serving (1 ounce). Because of the high percentage of carbohydrate, cereals are excellent sources of energy. Quantitatively, cereals are also good sources of protein, especially in low-cost diets where large proportions of cereals predominate. However, in quality, the protein is less complete and needs supplementing with proteins from animal sources. Cereal grains are deficient in calcium and in vitamins A, C, and D. The remainder of the mineral and vitamin content depends upon the milling process. Whole grains are good sources of phosphorus, iron, and thiamin and contain less of riboflavin. Sprouting grains develop ascorbic acid. Wheat and barley may be sprouted. Wheat germ is a good source of thiamin and riboflavin.

Some cereals are irradiated to increase their vitamin D content; other cereals are fortified by the manufacturer with certain minerals and vitamins. The laxative properties of whole cereals are due to the cellulose of the bran layers and possibly, in addition, to the presence in the bran of a substance called phytin (a compound of phosphorus). The energy and protein values of all cereals, pound for pound, are approximately equivalent. The mineral and vitamin content varies with the kind.

The following terms are used in connection with cereals.

Whole grain products: carry full food value of whole grain.

Enriched products: definite amounts of iron, thiamin, and niacin have been added to refined cereals or flours.

Restored products: iron and synthetic vitamins have been added to refined products to restore them to the value of the whole grain.

Fortified products: varying amounts of minerals and vitamins have been added to cereal products.

Refined products: bran and germ have been removed in the manufacturing process.

Place in the Diet. The importance of cereals and cereal grains in the diet is demonstrated by the fact that one-third of the total calories consumed by the people of the United States comes from this group of foods and that it is suggested by nutrition authorities that one-fifth or more of the food money be expended on cereals and cereal products including breads. Whole grains are especially valuable in low-cost diets because they furnish some of the minerals and vitamins likely to be low in diets when families have to cut down the amount of milk, eggs, fruits, and vegetables to the minimum. This is shown by figures from the United States Department of Agriculture Yearbook 1939, which indicates that the amount of cereals per capita per year is 240 pounds on a restricted diet level, 224 on a minimum-cost adequate diet level, 160 on a moderate-cost adequate diet level, and 100 on a liberal-cost diet level.

Cereals can be used not only in their familiar breakfast forms but also to extend meat dishes, as in meat loaf, meat patties, stuffings for the cheaper cuts of other meats, and thickening for gravies. The whole-grain and enriched flours can be used in any kind of flour mixtures. Many puddings and cookies may be made from cereals. These cereal dessert dishes should be served in meals that do not have cereal in the main course.

Some whole-grain or enriched cereal product should appear at every meal. Wheat germ may be used freely on cereals, on salads, or in fruit juices. It may also be used in any flour mixtures, such as cookies, waffles, and quick breads, in the proportion of 2 level tablespoons added for every cup of flour used.

Nutrition authorities tell us that at least one-half of all the cereals and cereal products used should be in the form of whole

grain and the rest enriched. Table 27 gives iron and thiamin figures for 1-ounce portions of some cereal products.

TABLE 27

IRON AND THIAMIN IN CEREAL PRODUCTS, 1-OUNCE PORTIONS

Cereal Product	*Iron, mg.*	*Thiamin, mg.*
Barley, pearl	0.6	0.053
Bran, prepared	5.0	.141
Bread, pumpernickel	0.45	.058
Bread, rye	0.46	.039
Bread, white	0.27	.020
Bread, enriched	0.52	.073
Bread, 100% whole-wheat	0.87	.094
Cornmeal	0.27	.052
Farina, dark	1.47	.152
Flour, white	0.3	.025
Flour, enriched	0.6	.012
Flour, whole-wheat	1.17	.150
Noodles, cooked	0.06	.0007
Oatmeal	1.45	.168
Pablum	8.10	.29
Rice, brown steamed	0.151	.020
Rice, puffed (added vitamins)	0.366	.577
Rice, white	0.26	.01
Wheat flakes (added vitamins)	1.59	.129
Wheat germ	2.25	.90
Wheat, puffed	0.94	present
Wheat, shredded	1.36	.093
Wheat, whole, flaked	1.5	.170

Cereal Cookery. Many cereals come in ready-to-serve form, having in their favor the advantage of saving time, labor, and also fuel. They are relatively more expensive and their use will depend upon how carefully the food money has to be spent.

Although cereal grains were probably first consumed without any previous preparation and later parched with heat, the palatability of the product that has been placed in water and treated with heat is now preferred. The cereals requiring cooking include whole and cracked grains and many of the granular forms. Cereals are cooked to improve their appearance, to increase their palatability, and, in addition, to make them more digestible. Previous manufacturing processes, such as crushing, grinding, and partial cooking, accomplish these purposes in part, but further cooking in the home is necessary. The cooking of cereals

is fundamentally the same as the cooking of starch; changes in starch during cooking have already been mentioned. In addition, cooking softens some of the crude fiber that is necessary in order that the starch kernel may swell. Cereals swell slightly in cold water, and this swelling increases as the water is heated until the thickening point is reached.

WHEAT FLOURS

Varieties of Wheat. Two varieties of wheat are used in the making of white flour: spring wheat and winter wheat. Spring wheat is sown in the spring, grows and matures during the short hot summer, is harvested in the fall, and produces what is known as hard wheat. It contains a higher percentage of gluten, is lower in starch and moisture, and is well suited, because of its high gluten content, for making yeast bread. Winter wheat is sown in the fall, remains in the ground during the winter, matures in the early summer, is harvested in the summer, and produces what is known as soft wheat. It contains a high percentage of starch and little gluten and is better adapted to making quick breads, cake, and pastry.

Varieties of Flours. Kinds of flours include the hard and soft wheat flours mentioned above, family flours, and graham flours. Hard-wheat flour, or bread flour, may be recognized by its creamy whiteness, its gritty feeling when rubbed between the fingers, its great capacity for absorbing water (because of which a product of great volume may be secured), and the fact that it will not hold its shape when pressed in the hand.

The protein exists in what is commonly known as gluten but in reality is a mixture of two proteins, gliadin and glutenin. The value of flour for yeast mixtures depends upon the ratio of these two proteins, gliadin giving elasticity to gluten, and glutenin giving strength. It is because of the power of expansion possessed by gluten that the dough is enabled to hold the gas produced by the yeast, preventing its escape until the desired degree of lightness has been reached.

Pastry flour or soft-wheat flour or cake flour is much whiter in color, has a smooth starchy feeling, holds its shape when pressed in the hand, and gives a light porous mixture, being better suited for baking powder or baking soda mixtures. Fam-

ily or general-purpose or all-purpose flour resembles a blend of both hard and soft wheats, is not too good for yeast bread, but is acceptable for yeast rolls, pastries, and quick breads. Prepared flours of various kinds are also available.

Graham flour is made from the whole grain of wheat, being named for a Sylvester Graham who, many years ago, advocated the use of whole-grain products. Graham flour is also known as whole-wheat or entire-wheat flour.

Gluten flour is made from spring wheat from which most of the starch is supposed to be removed, but its advertised low starch content is questionable.

Preparation of White Flour. Today flour, for the most part, is made by what is called the high-roller process of milling, which consists of a series of grindings between steam rollers followed by a sifting through fine sieves. After these grindings comes a separation of the wheat into various products. A carload of wheat, after grinding, makes several kinds of flours, depending upon the portions of the ground substances and ratios used. The different kinds include straight grade, patent, and clear: patent is the best, straight grade is not quite as good but is satisfactory, and clear is a lower grade than patent. The grade of flour is determined by the milling process; the more highly refined the flour, the higher the grade. As the quality decreases, the flour contains more of the protein and minerals, since more of the germ and bran go into the flour. Much of the flour available is bleached to increase the whiteness. Unless flour is distributed in the same state in which it is produced, a federal ruling requires that the package be labeled "bleached."

Wheat flour is probably the most important of all manufactured cereal products since approximately 100 million barrels are consumed yearly in the United States.

Enriched Flour. Early in 1940, a committee on foods and nutrition, now called the Food and Nutrition Board, was organized by the National Research Council at the request of the government in order to provide scientific guidance for the national nutrition program. Part of this board's work was to study many important groups of foods and their contributions to an adequate diet. When the members took up their work, it was recognized that attention should be paid early to wheat flour and its products since they contributed more calories to the

American diet than any other class of foods. Previously much criticism had been made of white flours and breads on the basis of poor nutritional value because of the nutritional superiority of the whole-wheat products over white, the increasing nutritional significance of vitamin B_1, which was removed in milling, the studies showing that large amounts of cereal products were necessary in low-cost diets, and the general popularity of the white products. Further, in 1940 white flour in England was fortified with thiamin and calcium, and Canada was experimenting with Melior bread made from undermilled flour. The problem of fortification of foods had also received a great deal of study by scientists, millers, and bakers.

In 1941, official standards and definitions for enriched flour and enriched bread were established by the federal government. These standards dealt with mineral and vitamin additions to flour and were approved by the Food and Nutrition Board. In January 1943, these standards were made compulsory for all white bread, rolls, and buns by the Food Distribution Administration. Under the standards, the additions of minerals and vitamins to the flour approximated those that would be found in flour by extracting 85 per cent of the wheat of high-vitamin quality or in a bread made from such a flour.

More recently, it has appeared advisable to improve these earlier standards by requiring still further additions of certain nutrients. These higher standards approximate those found in whole-wheat flour and whole-wheat bread and became effective for bread in October 1943. The new standards are shown below and are compared with the nutrients in ordinary white flour and whole-wheat flour.

	Thiamin	*Riboflavin*	*Niacin*	*Iron*
		(Milligrams per pound)		
Ordinary flour (white, patent)	0.3	0.15	3.5	3.0
Whole wheat	2.2	0.45	26.0	17.0
Enriched flour	2.0	1.2	16.0	13.0
Enriched bread	1.1	0.7	10.0	8.0

It has been estimated that the substitution of enriched products for unenriched varieties in the diet of the average person will improve the diet 39 per cent in thiamin, 16 per cent in riboflavin, 32 per cent in niacin, and 34 per cent in iron. As only white breads and rolls must be enriched by government

order, some unenriched white flour may still be on the market. Read the label and be sure to buy only enriched flour.

In addition to enriching flour by the method described above, the following methods are also acceptable. 1. Mill wheat in such a way that the flour contains some of the outer layers of the wheat grain. 2. Combine method 1 with the addition of vitamins and iron.

BREAD

Bread as a Food Article. Yeast bread, often spoken of as the staff of life, has long been considered one of the most wholesome and economical foods. Bread making in the home is an ancient art; commercially, it is thought to have started in Europe at an early date. Before the present century, bread probably held first place among the various food products. During the past thirty or forty years, the consumption has decreased and more of the energy content of the diet has been received from protective foods and sugars. Bread is made either entirely from wheat flour or from a combination of wheat and other grains.

Enriched Bread. Enriched bread is bread made in such ways as will make its iron, thiamin, and niacin content comparable to that of bread made from the whole-grain flour. It may be made by using flour enriched according to government standards or a white flour (produced under special methods of milling) which will contain more of the minerals and vitamins than the regular flour or a specially developed high-vitamin yeast or a combination of these three products. Since January 1943, all white bread and rolls sold have been enriched by government order. Enriched flour should be used in the baking of bread in the home.

At present there is a trend, in the commercial manufacture of bread, to use more milk and especially skimmed milk powder. As a result, a large proportion of the bread produced in the United States is thought to have twice as much calcium as the bread previously produced.

Home Baking of Bread. Although the manufacture of bread has been steadily shifting to bakeries during the past fifty years, much bread is still made in the home. Some controversy has existed as to the economy of home baking, but certain studies seem to indicate that savings can be effected, even considering

the market value of the time involved by the homemaker in doing so. The flavor of homemade yeast bread and rolls may be the sole feature for home production.

Composition and Nutritive Value. Bread is an economical source of energy. It also furnishes some protein: more protein and of a better kind if the bread is made with milk. Bread made with milk increases the calcium and phosphorus content; enriched flour adds iron, thiamin, and niacin. Bread made with whole wheat contains even more nutritive value than enriched bread. In homemade bread, the vitamins of the B complex may be increased by adding wheat germ to the flour.

Digestibility. The nutrients in white bread, like those of other cereal products, are digested and absorbed with relative ease and thoroughness. A light, thoroughly baked crumb is digested with less difficulty than a heavy or slack-baked bread that tends to form a mass in the stomach, resisting the action of digestive fluids. The crust of well-baked bread is partly dextrinized and is crisp and dry. Hot breads are less easily digested than yeast breads because the warm crumb tends to form a waxy mass in the stomach. Whole-wheat breads are only slightly less completely digested than white breads.

Other Flour Mixtures

Definition. The term flour mixtures is applied to those products in which flour is the chief ingredient. (Flours of various kinds were discussed earlier in this chapter.) Other essential ingredients are salt, liquid, and some form of leavening. Nonessential ingredients, which may be added to increase the palatability, to improve the texture, and to add to the nutritive value, include sweetening, shortening, seasoning, flavoring, fruits, nuts, and eggs. Flour mixtures include quick breads, yeast breads, sponge cake, butter cake, pies, tarts, and patties.

How to Buy Cereal Products. Numerous cereals and cereal products are available on the market, so many that the homemaker is often at a loss to know just what and how to choose. The availability of whole-wheat, all-purpose flours and of cake flours has already been discussed. Economies can be effected by buying these flours in larger rather than smaller units, provided adequate storage facilities and use warrant it. Self-rising flours

and ready-to-use flours are more expensive than the same products prepared at home, but the higher price may be justified on the time and convenience basis and, for an inexperienced cook, on the quality of the final product.

A choice may be made between bulk and package-form cereals; the latter are always more expensive, but the larger the package, the less the unit cost. Ready-to-eat cereals are also more expensive than those requiring cooking at home. The package here is advantageous from the sanitary standpoint, although the less highly advertised brands in cellophane coverings are frequently cheaper than the more highly advertised fancy-packaged forms.

White flours and polished rice are the only cereal products that are graded, although no standards of identity or minimum standards of quality have yet been set for these products by the Federal Food, Drug, and Cosmetic Act.

The label should be carefully read when buying cereal products to note if they have been treated in any way to increase their vitamin content. Something about the nutritive value can be estimated by the appearance, the darker varieties containing more nutritive value.

QUESTIONS AND ACTIVITIES

1. Cereals may be found on the market in cooked, partially cooked, and uncooked forms. List all the cereals according to these various groupings.
2. Which cereals cost more per serving, those which are ready to serve or those which require some cooking? Calculate the costs of five ready-to-serve cereals and five cereals which require cooking and compare for cost. With a few exceptions, 1-ounce portions of cereals (dry weight) constitute average servings.
3. Some cereals may be purchased in bulk as well as package. Which is more economical? Compare the costs of 1-ounce portions of rice, oatmeal, and whole wheat when purchased by the pound and in the package.
4. Distinguish between milled or refined and unmilled or unrefined cereals. What advantages do milled cereals have over unmilled ones? What disadvantages? List all the refined cereals on the market, the partially refined, the unrefined.
5. In what different forms is corn found on the market?
6. What do cereals lack for being a balanced dietary? How should they be supplemented?

7. Nutrition authorities tell us that one-half of all the cereals and cereal products in the diet should be in the form of the whole or unrefined grain. How do you account for this?

8. How are cereals improved by cooking? List the principles of cereal or starch cookery.

9. List ways other than as breakfast cereals that cereals and cereal products may be served. How can the service of breakfast cereals be varied?

10. What place do flour mixtures as represented by quick breads, yeast breads, and cakes have in the diet?

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CHAPTER XIII

MEAT, POULTRY, FISH

MEAT

Meat as an Article of Food. Up until 1929, meat production increased in the United States; since that time, there has been a gradual decrease. There has also been a change in the kinds of meats produced, the production of pork having increased more rapidly than that of beef.

The United States has been a large meat-eating nation but, until quite recently, the consumption of meat has decreased, since the many families on low incomes could not afford to buy meat. Even though Americans have increased the amount of money they spend on fruits, vegetables, and milk, not too long ago they were still spending more money for meat than for any other type of food. It was estimated that one-third of the total food money was spent on meat.

Structure of Meat. Meat is the flesh of animals that is used for food and consists of muscle, fat, and bone. If the muscle, which is commonly known as the lean meat, is examined under the microscope, it is seen to be made up of bundles of fibers held together by a thin membrane called connective tissue. Further study reveals the fact that these fibers are, in reality, hollow tubes that vary in length in different animals and in different muscles in the same animals and that are filled with a fluid, sometimes called muscle juice, which is known to contain protein, minerals, and extractives. The forms of protein in the muscles are myocin (a globulin) and myogen (an albumen) and, in addition, in red meats, hemoglobin.

The amount of connective tissues in meat varies with the sex and age of the animal and the extent to which a muscle is exercised. In the connective tissue are two proteins, collagen, occurring in the white tissue and capable of being converted into

gelatin by long cooking with moist heat, and elastin, occurring in the yellow and not affected by these processes. The gelatin formed from the collagen is also a protein, but it differs from myosin and myogen in that it is incomplete, lacking some of the necessary amino acids.

Fat, besides occurring in protective masses around certain organs, is also found among the fibers of lean meat. It increases the food value, decreases the water content, adds flavor, and helps to retain the moisture when meat is cooked by dry heat, as in broiling and roasting.

Bone is found in meat in varying amounts, but, aside from imparting flavor, it has little value. Extractives give characteristic flavor to the different kinds of meat, some having more of them than others. It is probably to these appetizing and stimulating substances that meat, especially beef, owes its wide appeal. The resulting flavor will always insure it a foremost place in the diet, when the budget allows.

Kinds of Meat. Meats are usually classified, in a broad sense, to include: (1) meat proper, as beef, veal, mutton, lamb, and pork; (2) poultry, any domestic fowl, and (3) game, anything hunted in field or forest. In the sense that meat is the flesh of the animal, a fourth group, fish, might be added to the list, but the term meat, as ordinarily used, applies to the first group only. According to meaning (1), meats may be further classed as tough or tender.

Both tough and tender meat may come from the same animal but from different parts. The muscles that are used the least and have a minimum amount of yellow connective tissue furnish the tender cuts. These are more expensive and more easily cooked but are less juicy and may often be quite lacking in flavor. The muscles that have been used and exercised a great deal furnish the tougher cuts. These, however, are rich in nutriments and flavor and, when properly cooked, may be quite as tender as the more expensive cuts.

Both the texture and flavor of these meats are dependent upon a process of ripening, which means that the carcass is allowed to hang for a certain length of time at a temperature just above the freezing point. During this time, the meat is subject to the action of certain enzymes and microorganisms which promote the formation of an acid. This acid in turn helps to soften the

coagulated proteins of the muscle juice (caused by the rigor mortis or stiffening of the muscles after the animal has been slaughtered) and imparts tenderness and additional flavor. If ripening is continued for too long a time, a "gamey" flavor, which is liked by some people and disliked by others, develops. Carcasses, to be ripened successfully, should have a covering of

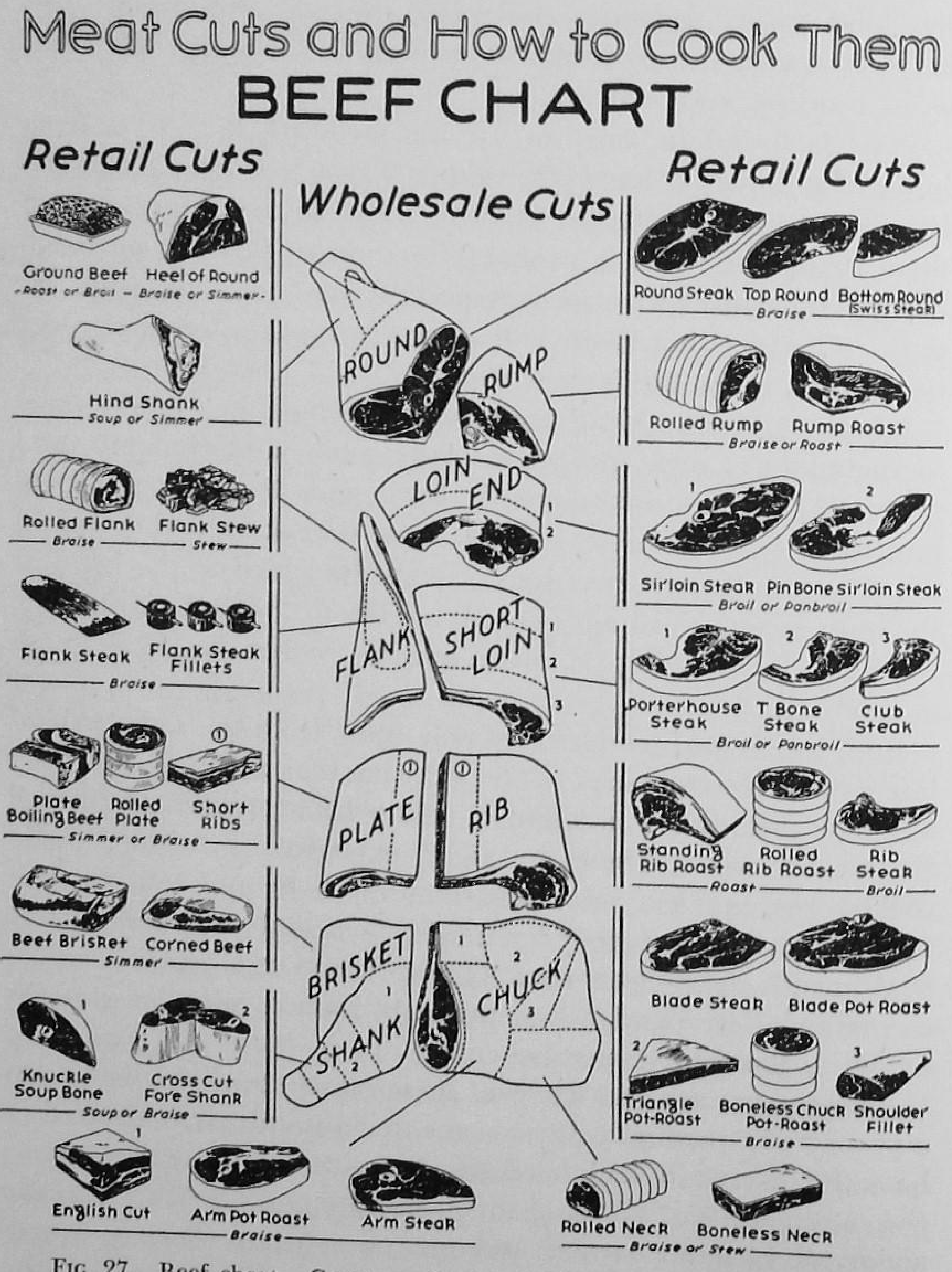

Fig. 27. Beef chart. Courtesy, National Live Stock and Meat Board.

fat, since it inhibits the growth of putrefactive organisms and favors the action of desirable enzymes. Pork is never ripened.

Beef. Beef, the flesh of cattle, is probably more extensively used, with the exception of pork, than any other meat. Beef from animals raised on the farm is considered superior to that of ranch cattle. The reason for this may be that the farm animals are grain fed instead of grass fed and that they also have less exercise, resulting in tenderness of tissues.

Good beef has the following distinguishing characteristics. It comes, preferably, from a steer no older than six years, is firm, fine grained, elastic, and, when touched, hardly moistens the finger. When freshly cut, it is bright red. The lean part is well mottled with yellowish fat, and the fat around the edge is firm, clear, and free from spots. Dark streaks through the lean show carelessness in draining off the blood after slaughtering. Beef is almost odorless, and, when tested with litmus paper, the reaction should be acid; an alkaline or neutral reaction denotes either the use of a preservative or putrefaction.

Official United States grades for beef from steers and heifers include U. S. Prime or A1; U. S. Choice or 1; U. S. Good or 2; U. S. Commercial or 3; and U. S. Utility. The grades for beef from cows, bulls, and stags begin with U. S. Good. The grading and the stamping of beef, over and over down the length of the carcass with a roller stamp, is done by official United States Department of Agriculture graders. The grading of beef is optional with the packer.

Veal. Veal is the flesh of the calf, usually no older than two to three months. It differs from beef in that the cuts are very much smaller, it is pink in color, and the fat, present in small amounts, is whiter than that of beef fat. Much connective tissue is present in veal, but extractives are less than in beef.

Veal is at its best in the spring and summer and when the animal has been fed wholly on milk. Because of the quality of the bones and tendons of veal, much gelatin can be obtained from it as is indicated by the familiar jelly-like consistency of broth from veal when allowed to cool.

Veal is graded U. S. Prime or A1; U. S. Choice or 1; U. S. Good or 2; U. S. Medium or 3; U. S. Plain or Common or 4; and U. S. Culls or 5. The first three are the only ones generally available.

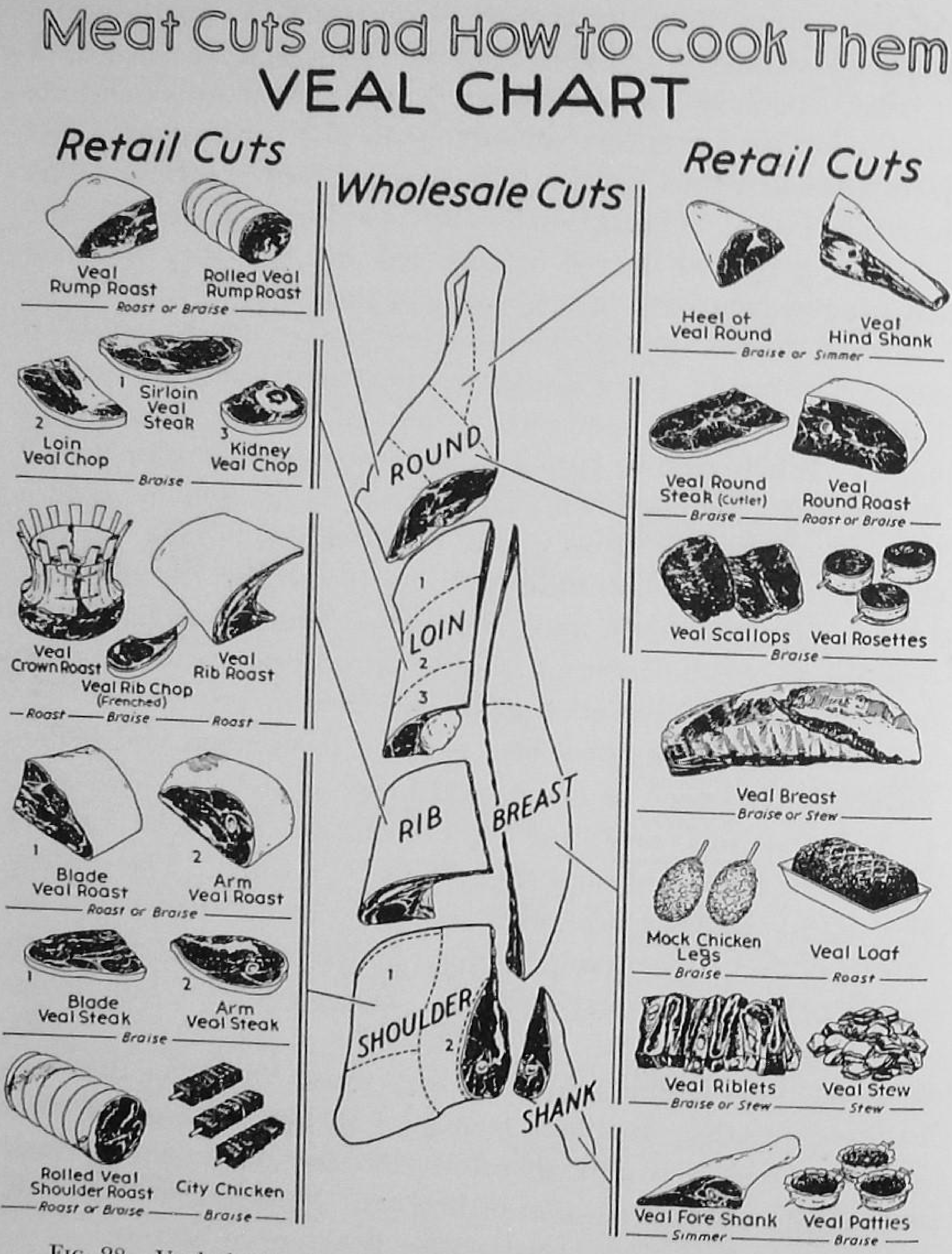

FIG. 28. Veal chart. Courtesy, National Live Stock and Meat Board.

Mutton and Lamb. Mutton comes from sheep or more mature animals, usually no older than three years; lamb comes from a young animal less than one year old; spring lamb comes from an animal two to three months old.

The flesh of mutton should be fine grained, firm, dull, and red and should have fat that is white in color and hard, rather than oily, in texture but well distributed through the lean. The

Fig. 29. Lamb chart. Courtesy, National Live Stock and Meat Board.

peculiar flavor of mutton is due to the nature of the fat (mostly stearin) and the absence of extractives. The color of the flesh of the lamb differs from mutton in being pinkish, and the fat is less in amount and more hard and flaky; but a more satisfactory way of distinguishing between them is by examining the bones. In the mutton, the bones are hard and white, round and smooth;

in the lamb they are soft and red, also serrated. The ends of the leg bones are separated from the shaft in young animals; in the old, the ends become part of the shaft, forming one bone. The grade designations for lamb and mutton are the same as for veal.

Pork. Pork is the flesh of a hog and is best when obtained from an animal between seven months and one year old. Because of the large amount of fat in pork, many persons are prejudiced against its use; nevertheless about one-half of all the meat sold in the United States is pork, either in its fresh state or cured. Cured pork means the meat was subjected to such processes as salting and smoking. The tissues lend themselves particularly well to smoking; the flank, so prepared and sold under the name of bacon, is especially relished, either with or without eggs, for breakfast. As a result of this treatment, the fat of bacon is one of the easiest of all types of fat to digest.

Although pork is susceptible to the attack of a parasite (*Trichina spiralis*) which is known to produce the disease trichinosis in the human body, the high degree of heat necessary to develop the desired agreeable flavor in cooked pork and to make it palatable to most persons very successfully rids the meat of such a parasite, if present. At the present time, there is little, if any, danger from using pork, provided it is thoroughly cooked, in moderation in the diet.

In selecting pork, the color is a good indication of quality. The flesh of the young animal is light pink, that of the older one, darker in color. The bones are somewhat reddish, rather small, and of a more or less spongy texture. The fat should be white and smooth and very firm, that surrounding the kidneys being used for the well-known leaf lard. Coming, as it does, from a young animal, and having little connective tissue, pork is always tender. As it is deficient in extractives, it naturally lacks flavor, but this may be developed by the proper methods of cooking. Pork is graded 1, 2, 3, and culls. Cuts of beef, veal, lamb, and pork are shown in Figures 27 to 30.

Internal Organs Used as Food. Because of recent food studies that show internal organs to be of great nutritional value, these parts of the animal, always highly prized in the diet of Europeans, are gradually coming into favor in this country. More recently, they have come to be known as variety meats.

They are often higher in food value and lower in cost. Included are liver, heart, kidneys, sweetbreads, brains, tongue, and tripe.

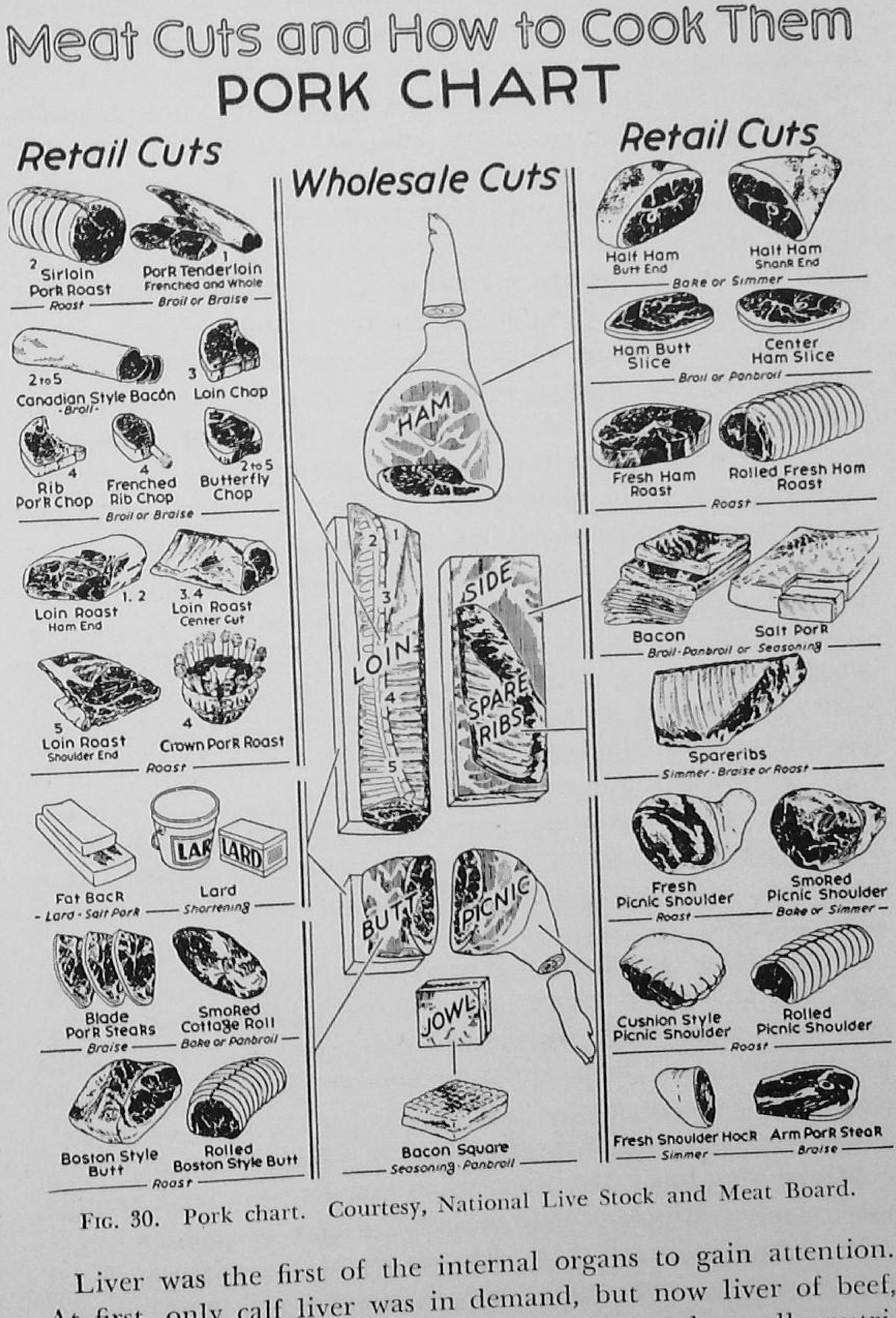

FIG. 30. Pork chart. Courtesy, National Live Stock and Meat Board.

Liver was the first of the internal organs to gain attention. At first, only calf liver was in demand, but now liver of beef, lamb, and pork is available, less expensive, and equally nutri-

tious. It is cooked by frying, braising, scalloping, broiling, or grinding for use in meat loaves.

Heart is much like muscle meat but, being very compact in texture, requires long, slow cooking to insure its digestibility. Beef, lamb, pork, and veal hearts may be simmered and served with gravy, stuffed and baked, or ground for use in meat loaves.

Kidneys from beef, pork, veal, and lamb are also compact but contain no connective tissue and therefore are tender when properly cooked. The small kidneys may be broiled; the larger ones, stewed, braised, or made into loaves after grinding.

Sweetbreads, considered a great delicacy, are the thymus gland of the calf or lamb, the calf's being more choice. They consist of two parts, the heart and the throat sweetbread, connected by a membrane, the former being more delicate and cellular in structure. The cells are held together with loose connective tissue. When at their best, they are plump, firm, white, and easily digested. The pancreas of the older animal is sometimes sold as pancreas sweetbread, but it is less tender than true sweetbreads. They may be simmered, the connective tissue carefully removed, and then broiled, fried, or creamed.

The brains of beef, lamb, veal, or pork may be prepared by creaming, frying, or scrambling. Tongue is usually understood to be that of beef, marketed as smoked, but may be from the pig, calf, or lamb, the last three more often sold in pickled form. Fresh and corned tongue are also available.

Tripe is the cleaned and boiled lining of the stomach of the calf or steer and is largely composed of connective tissue. It is simmered until tender, sliced and fried, or creamed. It is sometimes pickled.

Other Meat Products. Prepared meats include dried and corned beef, canned meats, cured hams, frankfurters, bologna, and liverwurst. Bulk sausage, scrapple, pig's feet, and oxtails are also available. By-products include bouillon cubes and meat extracts.

Composition and Nutritive Value. Meat is an expensive article of diet, but it does furnish an excellent source of protein to the body. Muscle protein is similar to that of milk and eggs. The energy value of meat depends upon the amount of fat present, but, in no instance, would it be a cheap source of energy. It contributes minerals, notably phosphorus and iron, and also

vitamin B_1. It is deficient in calcium, vitamins A and C, and carbohydrates, the only one of these present being glycogen, stored for the greater part in the liver but present also, to a much smaller extent, in the muscles.

Lean-muscle meats are good sources of phosphorus and iron, riboflavin, niacin, and thiamin. Pork contains more thiamin than beef. Liver contains more vitamins A and C than muscle meats and is also valuable for iron and copper. Pig liver is higher in iron than liver from any other animal. Kidneys rank next to liver as sources of iron. Heart and brains are good sources of thiamin. Iron occurs in the muscle juice in varying amounts, being present to a smaller extent in the young animal than in the older one. The nitrogen extractives, previously mentioned, give flavor to the meat and stimulate the digestive juices.

Place of Meat in the Diet. The emphasis that has been placed on meat in the diet is indicated by the fact that people in the United States have spent approximately one-third of their food money for meat. This has meant that almost one-fifth of the calories, over one-third of the protein, and approximately one-third of the iron requirement have come from meat.

Meats are especially prized for their flavor and the interest they add to the diet. They are not completely indispensable in the diet. In times of scarcity or high price, other foods must be substituted for meats. Other animal proteins in milk, eggs, and cheese are equal to meat in nutritive efficiency. The protein of soybeans comes nearest to animal proteins in nutritive efficiency, making soybeans an almost perfect substitute from the plant world. Dried beans and peas, peanuts, and other nuts may also be substituted for meats; cereal dishes add some protein to the diet. When using these latter suggestions as meat substitutes, some milk, eggs, or cheese should be included in the same dish or meal.

Small amounts of meat may be extended by the use of cereals, bread, potatoes, rice, etc., in casserole dishes, meat pies, croquettes, scalloped dishes, and the like. Drippings and gravies from meats may be used for flavor in some of the meatless dishes.

How to Buy Meat. Certain standards and regulations have been set up in regard to meat by the United States Department of Agriculture. If meat is to enter interstate commerce, it must

be inspected for wholesomeness by United States government inspectors as required by the Meat Inspection Act of 1906. When meat has been passed as being wholesome, a round purple stamp is placed on it. This stamp is in no way connected with the grade. It simply insures the buyer that the meat is of wholesome quality. Meat produced and marketed within a state need not carry this mark but most states have similar regulations regarding such meat.

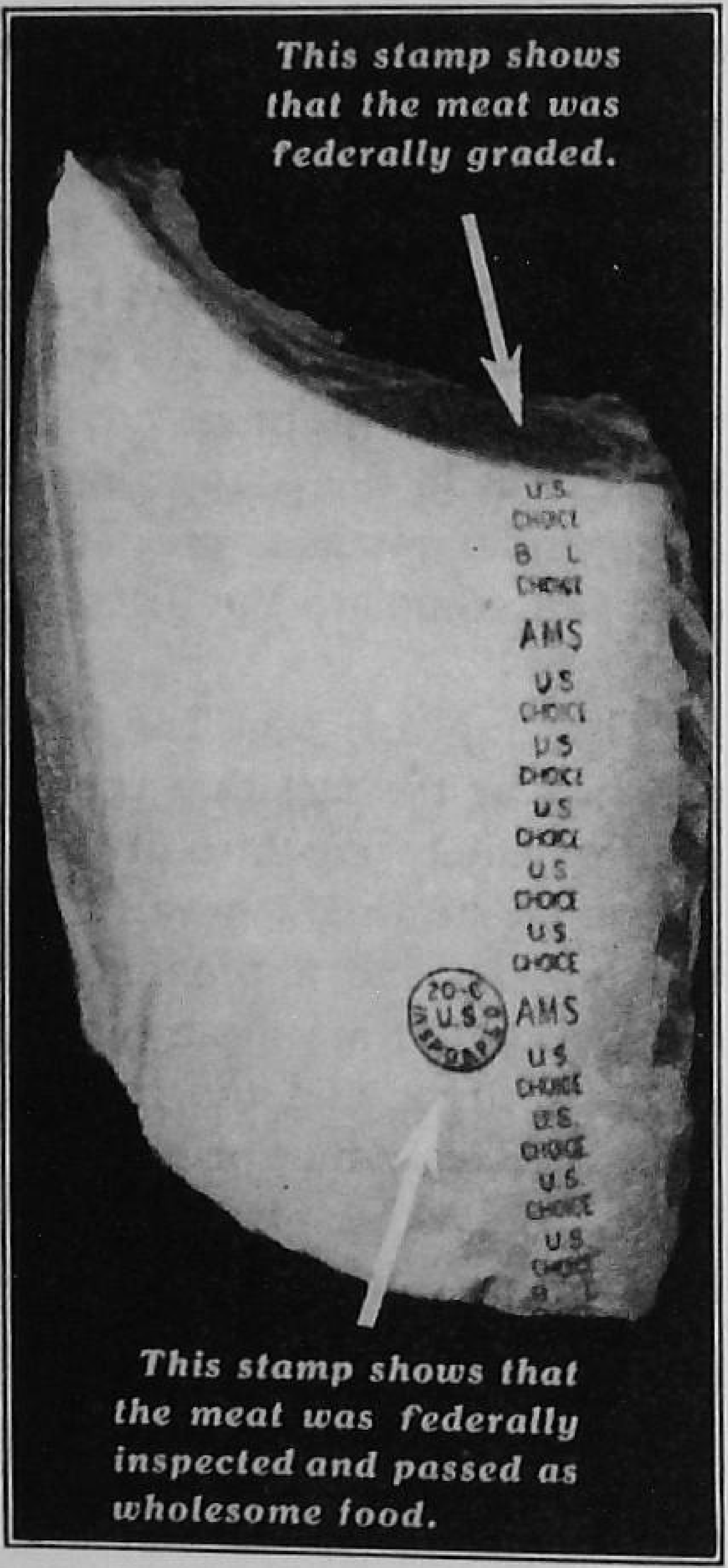

FIG. 31. Inspected and graded meat. "Buying beef by grade," *United States Department of Agriculture Miscellaneous Publication 392.* Courtesy, United States Department of Agriculture.

Official United States standards for grades of carcass meats have also been established. They are based on the conformation of the carcass, its finish, and quality, with attention paid to tenderness, flavor, color, and juiciness of meat and amount of fat. Beef, veal, lamb, and pork grades have already been given under previous sections. When meat is graded by government graders, the grade is applied the length of the carcass with a rubber roller stamp. The grading of meat is optional by the packer, whereas the inspection mentioned above is mandatory. Figure 31 shows a cut of meat with both the inspection and grade stamping.

Higher grades of meat are more expensive than lower grades but the latter are equally nutritious and satisfactory if prepared by the correct methods. Tender cuts are likewise more expensive than tougher cuts. However, the tougher cuts are equally good in nutritive value and can be prepared very satisfactorily. Less

expensive cuts from higher-grade animals may prove better buys than higher-priced cuts from lower-grade carcasses.

The amount of waste must be considered in buying meat. The low price per pound of some meats may be offset by the amount of bone and connective tissue. It is well to determine the cost per pound of edible meat from various cuts in order to learn which are the most economical cuts to buy for the purpose desired.

Meat, in any form, especially when chopped, is a perishable product. Fresh meat should be wiped with a damp cloth, covered lightly with waxed paper, and stored in the coldest part of the refrigerator. Chopped meat should be used as soon as possible after purchase; this is also true of the variety meats. Cooked meats should be covered tightly, to prevent their drying out, before placing in the refrigerator.

Meat Cookery. *Changes in Meat during Cooking.* Muscle proteins are coagulated by heat, the coagulation starting at 126° Fahrenheit. They, like other food proteins, are toughened with high temperatures or long-continued heating even at low temperatures. Collagen in the white connective tissue is converted into gelatin slowly by dry heat and quickly by moist heat. Too long cooking of meat will cause the muscle fibers to fall apart as all of the collagen becomes converted to gelatin. Acid hastens this conversion. Elastin in the yellow connective tissue is not affected by moisture and heat.

Methods of Cooking. The purpose of cooking meats is to destroy organisms, improve the appearance and attractiveness, improve the flavor and palatability, and soften and loosen the fibers so that the meat will be tender and easy to digest.

The method to be used in cooking meat depends upon whether the meat is tender or tough. Tender meats must be kept tender throughout the cooking process, must have a good appearance and flavor, and must be juicy. Tough meat, with its thickened fiber walls and large amounts of connective tissue, must be made tender by the cooking process. The basic methods for cooking meats include dry heat, as pan broiling, broiling, and roasting, and moist heat, as braising and cooking in water (stews, soups, broth). Dry heat methods are used for tender cuts of meat, moist heat methods for less tender cuts.

Shrinkage of meat and losses from evaporation or the loss of water and volatile substances in pan drippings (fat, salts, water, extractives) are problems in the roasting of tender cuts. Losses from meat during roasting have been found to be less in larger than in smaller cuts, in cuts with a smaller percentage of fatness than those of extreme fatness, when searing is omitted (searing does not keep in the juices), when roasting at lower rather than higher temperatures, in meats cooked only to the rare or medium stage rather than to the well-done stage, when roasted in an uncovered pan (veal and pork are exceptions). Meats cooked with these conditions in mind are better in flavor, are more juicy, and provide more servings, since they shrink less.

Studies made by the Bureau of Human Nutrition and Home Economics on the effects of different roasting temperatures on three 12¼ pound roasts that were cooked to an interior temperature of 140° Fahrenheit showed the following results. Roasts cooked for 3 hours at 450° from start to finish lost 4 pounds during roasting and yielded 2 pounds of pan drippings. Roasts cooked at 500° for 20 minutes and then at 300° for the remainder of a 4-hour period lost only 2 pounds and yielded only 1 pound of drippings. Roasts cooked at 250° for 5 hours lost 1½ pounds and yielded only ½ pound of drippings. The last method also saved a considerable amount in the gas consumed.

Less tender cuts of meat may be improved by scoring with a knife, pounding flour into them, grinding them before cooking, or cooking them with tomatoes. Long slow cooking, at a temperature below boiling, in a covered utensil is necessary for the less tender cuts.

Effects of Cooking on the Vitamins. The effect of various cooking methods on the B vitamins in meat has been of interest to the scientist. Recent studies on pork loins and hams show that there is very little difference in the total vitamin content in meat prepared by braising, roasting, and broiling but that there is a difference in the amount of vitamins retained in the meat alone as follows: braising resulted in lower retention of thiamin, niacin, and riboflavin than did either roasting or broiling. Vitamin G was retained to the greatest extent, niacin slightly less, and thiamin the least. This study further showed that the largest loss in the drippings occurred with braising and the least with roasting, although there were variable factors in each case.

It is wise, therefore, to use the drippings or juice regardless of the method of cooking.

Studies on veal gave similar results to those on pork and ham; roasting resulted in the greatest retention of the three vitamins, stewing the least, and braising intermediate between the other two methods. It would appear to be true that, even after cooking, meat is still a good source of the B vitamins, providing that proper cooking methods are used and the drippings utilized.

Digestion. Meats, in general, and especially those rich in extractives that are known to have a stimulating effect on the flow of gastric juice, are digested with ease, calling for little mechanical effort on the part of the digestive organs. Chemical action reduces the protein into its original amino acids, in which form it is absorbed. The amount of fat present and the method of cooking may slow up digestion a little but do not interfere with its completion, the coefficient of digestion of meat being practically the same as that of other proteins.

The prevailing opinion that red meat, pork, and the tender cuts are less completely digested than white meat of chicken and tender cuts does not appear to be well founded. Meat, unlike fruits and vegetables, leaves an acid residue after digestion, absorption, and metabolism. This is of no special significance since meat in the usual diet is well balanced with fruits, vegetables, and milk.

Preservation. Meat is so susceptible to bacterial action and can be kept in the fresh state for such a very short time that some means of preservation is necessary. Methods include drying (which dates back to primitive man who used this method for preserving his animal food), smoking, corning, pickling, and canning. The latest method to be used by large industries is freezing, which is conceded to be the most satisfactory if the meat has to be kept for long periods of time, since it gives a product little different from fresh meat. By the older method, "slow freezing," the muscle juices were frozen solid, the fibers themselves being separated by layers of ice. This method was thought to injure the walls of the meat with a resultant loss of nutriment when thawed out. The newer and superior method, "quick freezing," is accomplished so quickly that it prevents the formation of large ice crystals or any changes in the meat.

Frozen meats may be cooked in the same way as fresh meats.

They keep indefinitely in the frozen state, but they should be cooked immediately after thawing. The food value of frozen meat is thought to be the same as before freezing. In some cases, the meat is more tender than before freezing.

Tenderized Meats. Such mechanical methods for making meats tender as grinding and pounding, by which the connective tissue is cut and the meat softened, are familiar to all. More recently, cubing and chipping processes have been introduced for the same purpose. Cubing is accomplished by cutting the meat at regular intervals with a machine. Chipping is accomplished by slicing frozen meat into thin chips, piling these chips one on top of the other (about 6 pieces for a 1¾-inch steak), individually wrapping each steak, and keeping it in the frozen state.

Tenderizing has also been effected to a certain degree in smoking, curing, pickling, and corning. Newly developed methods for tenderizing hams have included the introduction of a curing fluid containing, among other things, the protein-hydrolyzing enzymes, bromelin and papain, along the bone or directly into the meat.

The Tenderay process, used for tenderizing beef, was introduced in 1938 to reduce the time required by the natural ripening of beef. Natural ripening of beef requires a comparatively long time, 4 to 6 weeks, during which time (the so-called period of hanging) enzymes act on the meat to soften the connective tissue. At the temperatures at which meat must be kept to prevent spoilage occurring, the enzyme activity is slow; increasing the temperature to facilitate enzyme activity would encourage the growth of undesirable bacteria.

By means of a Steri lamp, developed by Westinghouse, which destroys the spoilage bacteria and maintains a sterile atmosphere around the meat, meat may be ripened or tenderized at high temperature, at which enzyme activity can proceed rapidly. The expense and time of hanging are thus cut down, and the result is a more tender, juicy, and less grainy product. Loss of moisture is also prevented.

POULTRY

Poultry as an Article of Food. As early as 1825, chickens were grown commercially in the United States for feathers; it

was not until much later that meat production was the primary objective. Poultry is now produced on a small scale on 90 per cent of all the farms in the United States with the possible exception of the southeastern states. Commercial production on a large scale is more or less limited to the Pacific coast states, the northeastern section of the country, and the region of the Mississippi valley.

Kinds and Characteristics. Under the heading of poultry come such domestic birds as chickens, turkeys, ducks, geese, guineas, squabs, and pigeons. The most extensively used are chickens, turkeys, and ducks. They are available alive or dressed, preferably dressed. Poultry is sometimes designated as milk-fed, which simply means that for a period before they are killed a certain amount of milk is added to their food. This seems to whiten the skin and flesh and make the muscular tissue more tender. Corn-fed poultry is fatter and yellower in color, with fat not so well distributed through the muscles.

Dressed poultry may be scalded before plucking, semi-scalded, or dry picked; drawn (entrails, head, and feet removed) or undrawn; fresh dressed (cooled but not chilled or frozen), fresh hard chilled (frozen to preserve during shipping and marketing, held 60 days or less), or cold storage (frozen by sharp freezing and stored over 60 days) or quick frozen; dry packed or ice packed. Frozen chickens all prepared for cooking may now be purchased in packages.

All poultry have certain characteristics in common, beside their own specific ones. The body should be short and plump in proportion to weight, the flesh light in color, the skin smooth without any bruises or breaks, the legs smooth, and the breast bone pliable with the breast itself very plump; there may be pinfeathers in the young bird but no long hairs. The method of preparation for market has much to do with the quality; dry picking poultry as a means of removing the feathers is always to be preferred to scalding, which may injure the skin and add water to the flesh, thereby impairing the flavor. Scalding is indicated by a smooth, tightly stretched skin and legs hard to bend; dry-picked poultry has a flexible skin.

Turkeys under one year have black feet, a thin skin, and a flexible breast bone (explained by the fact that in young animals the bone is still in the form of cartilage, not yet having had time

to become hard and brittle). Like chickens, turkeys are best when dry picked and not packed in ice. A medium size, not more than 15 to 20 pounds in weight, is superior in every way to a larger one.

Ducks and geese, though in the market at all seasons, are more popular in cold weather because of their high fat content. The condition of the windpipe is one way of distinguishing between the young and old; with age, the windpipe hardens. Geese contain a higher percentage of fat than ducks. The highly prized pâté de foie gras is made from the livers of geese especially fattened for this purpose.

Guinea fowls or hens are increasingly in demand in the early fall and winter. The flesh is darker in color and shorter fibered than chicken, and the flavor is more like game. Game includes wild birds and animals or anything hunted in field or forest, such as wild ducks and geese, quail, partridge, reed birds, squirrels, rabbits, and deer. (The flesh of the deer is known as venison.) When tender and properly cooked, they are liked and digested by many people. However, as they are especially rich in both natural extractives and those brought about as a result of hanging, they possess the "gamey" flavor found disagreeable to an uncultivated taste.

Classification. Poultry is classified as follows. Chickens include broilers, fryers, roasters, and capons, which are young birds, and fowls (hens) and roosters (cocks), which are older birds. Turkeys include broilers, fryers, young hens, and young toms, which are young birds, and older hens and older toms. Ducks and geese are classed as young and old birds of either sex. Squabs are young pigeons.

Composition and Nutritive Value. In muscular structure, poultry closely resembles other meat, and its nutritive value differs little from that of other meat. Poultry depends for its nutritive value upon the protein and fat present and compares favorably, in this respect, with other meat, the place of which it may take in the diet. The white meat of chicken, though poorer in fat than the dark, is equally high in protein. Poultry furnishes some iron, phosphorus, and vitamins B and G. Game is so distinctly a luxury and so little appreciated even by those who could easily afford it that it cannot be considered an essential part of our food supply.

Purchasing Poultry. The proportion of edible meat in poultry depends on the age and breed of the bird, its care, feeding, handling, and market preparation. Figures published by the United States Department of Agriculture indicate the percentage of edible meat (all of the drawn bird including heart, liver, and gizzard, but with the bones removed) to dressed weight (bird plucked and bled but not drawn) to be as follows: 63 per cent for fattened roasting chickens, 57 per cent for unfattened roasting chickens, 61 per cent for fattened broilers, 54 per cent for unfattened broilers, 67 per cent for capons, 64 per cent for hens, 60 per cent for ducks, 65 per cent for geese, 67 per cent for turkeys, and 74 per cent for squab pigeons.

To decide which is the most economical bird to buy, the actual price paid per pound of solid eating meat may be determined by dividing the price per pound for the chicken plucked and bled but not drawn by the percentage of edible meat to dressed weight.

United States Standards for grades have been established for both live and dressed poultry. The United States grades for dressed turkeys and chickens include U. S. Special or U. S. Grade AA, U. S. Prime or U. S. Grade A, U. S. Choice or U. S. Grade B, U. S. Commercial or U. S. Grade C. If birds have been graded according to these federal grades, a grade tag may be found on either the individual bird or on the carton in which a dozen birds are packed. More poultry is sold to the consumer, according to the commercial classification as broilers, roasters, fowls, etc., than on the basis of government grades.

Digestibility. Owing to the shortness of the muscle fibers in poultry, particularly those which make up the breast, and the absence of much fat and connective tissue, the meat of young poultry may be more easily digested than that from other sources. In ducks and geese, the fat content slows up the rate of digestion so that, in this respect, they are about on a par with pork.

Poultry Cookery. The cooking of poultry resembles that of other meats. Young birds, such as broilers, fryers, and roasters, may be cooked with dry heat; older birds, as fowls and roosters, require moist heat (stewing, steaming, and braising).

Poultry, like other meat, is best roasted at a slow to moderate temperature, the larger the bird, the lower the temperature and the longer the roasting time. The bird is placed on a rack in a

shallow pan, breast down to start, no water is added to the pan, and the pan is left uncovered and is placed in a slow to moderate oven. It is recommended that medium-sized birds be turned every half hour, larger ones every hour. Covering the pan during the last half hour of roasting is thought by some to prevent the skin from becoming tough and dry.

FISH

Fish as an Article of Food. The consumption of fish, compared with that of beef, is small, but it has increased during the past twenty-five years. One hundred and sixty varieties of fish are harvested, but twelve of these make up over 80 per cent of the total volume consumed. These twelve include salmon, pilchard, haddock, sea herring, cod, tuna and tuna-like fishes, shrimp, oysters, crabs, flounders, mackerel, and halibut. Fisheries are maintained in every seacoast state and Alaska, in the Great Lakes, the Mississippi River, and other interior rivers navigable to small boats. The fishery harvest is marketed fresh, frozen, salted, smoked, canned, and in the form of by-products, with about one-third fresh or frozen and the rest in other forms.

Classification. The usual classifications of fish group them: anatomically, into the vertebrate or scaly fish and invertebrate or shellfish; according to their habitat, as fresh water and salt water; and as to their fat content, white or lean fish, in which the fat is mainly confined to the liver, and oily or dark fish, where the fat is distributed throughout the flesh.

Salt-water fish include cod, haddock, halibut, mackerel, flounder, swordfish, herring, salmon, and tuna; fresh-water fish include bass, perch, pickerel, pike, shad, trout, and whitefish. Frogs' legs are usually classed with fish. Fish contains 20 to less than 0.5 per cent of fat. Fat fish, usually darker in flesh, include butterfish, catfish, eels, herring, mackerel, salmon, sardines, shad, swordfish, and turbot. Lean fish, white flesh, are black bass, bluefish, cod, flounder, haddock, hake, perch, and pickerel. Halibut falls between the very fat and leaner fishes.

Shellfish. Shellfish include mollusks and crustaceans. Mollusks have invertebrate and inarticulate (unsegmented) bodies, usually protected by a shell that enlarges to permit growth; they include oysters, clams, scallops, and mussels. To the crustaceans,

with their segmented bodies and crust-like shells, belong lobsters, crabs, shrimps, and crayfish. An important feature of shellfish production is that they must not come into contact with polluted water.

Oysters, perhaps the best known of the shellfish and the most extensively used, come from salt water. They vary in size, the smallest, known as Blue Points, measuring only 2 or 2½ inches. Oyster culture is carried on extensively in the submerged lands along the Atlantic seaboard. On the Atlantic coast, they are in season from September to May, are often eaten raw, and are easy to digest. The ease with which the oyster is known to transmit disease germs inspires fear in some persons, but there is little danger if the source of supply is not polluted. Oysters may be cooked, if they are not relished raw, but only lightly, as cooking toughens them. Oysters should not be allowed to stand in water after being removed from the shell both because they are apt to be contaminated and also because they lose some of their food value.

Clams, next to oysters, are perhaps the best known and liked; they too can be eaten raw as an appetizer, being very popular as such when oysters are not in season. For this purpose, the small round variety known as Little Necks are highly prized for their fine flavor. The soft round clam, called quahaug, is used for making the well-known New England chowder as well as for the popular clambake. Cherry Stones are also a popular variety. Steamed clams and clam broth are favorites.

Mussels resemble oysters but come from fresh water, have a stronger flavor, and are rather tough. They may be cooked in the same ways as oysters and clams.

Scallops, also a mollusk, are found on sandy beaches and shores, the muscle which serves to close the shell being the only part eaten. Bay scallops are small, sea scallops larger.

Lobsters, by many people the most appreciated of all shellfish, are particularly sweet in flavor owing to the large amount of glycogen present. The young ones, often called chicken lobsters, are very tender and easy to digest, but too large ones are likely to be tough on account of the coarseness of the fibers. Lobster tails, imported from Cuba, the Bahamas, and Africa, have become more and more popular.

Crabs are sold and eaten as hard- and soft-shell crabs, claw meat (claws only), white meat (small body flakes), and special lump meat (large body flakes). The crabs known as soft shell are those which have recently shed their shells and are more delicate in flavor than lobster. The hard-shell crabs are practically the same except that they are still in the old shell. The top, back, and claws of the soft-shell crab are edible.

Shrimp are sold without the head and are pearly gray in color until after they are cooked, when they turn the familiar pinkish color. The edible portion is the tail; the black intestinal thread which runs along it should always be removed. As one-fourth of the weight is protein, shrimps are a very good source of this foodstuff. They are palatable as well and are one of the few canned fish that have always had ready sale. Shrimps constitute the only canned-fish product protected by government service. This service was requested by the shrimp industry and has been in operation since 1934.

Other little-used fish products include crayfish or crawfish, a fresh water product resembling lobster but less tender and of quite a different flavor. Prawns are often confused with shrimps, for which they are sometimes substituted. Abalone comes from a snail-like creature and is used extensively in California. Its flesh is firm and white and has a flavor not unlike that of the clam.

Caviar is the preserved roe or eggs of the sturgeon and is prized for its flavor. The eggs vary in size from very tiny ones to those about the size of a small pea, and both the red and the black are on the market in ordinary times. Russian caviar is the best known; the smaller and blacker it is, the better grade. It is so distinctly a luxury now that its mention is only a matter of interest. Terrapin is but little known and very expensive. It is a turtle-like reptile found in the salt water of bays and lagoons, those of the Chesapeake Bay being much prized. The flesh is delicate in flavor and very digestible. The choicest variety is the Diamond Back. It is probably best known as terrapin stew.

Green turtles are used in soup. Turtle steak is also served, the meat of the cow turtle being more tender. Frogs' legs come from three different varieties of frog and are a very popular delicacy.

Selection and Care of Fish. Fish is available whole, split, boned, in fillets, and in steaks. Oysters and clams are available

in and out of the shell, and crabs, alive and cooked. All fish should be purchased from a reliable dealer who has adequate facilities for strict sanitation and refrigeration. Freshness in fish is indicated by bright, clear, and protruding eyes; stiff fins and tail; firm, elastic flesh; bright, fresh-colored gills; scales tightly adhering to skin; and a clear, characteristic, untainted fish odor. The shells of oysters and clams sold in the shell should be entirely and tightly closed. Crabs and lobsters should have bright eyes and be alive until the time of cooking. Frozen fish should be frozen throughout and be odorless.

The use of fish as soon as possible after purchase is recommended. Until time of use, it should be wrapped lightly in waxed paper and kept in the coldest part of the refrigerator. Frozen fish should be kept frozen until time of use; it should never be refrozen. Opened canned fish needs to be treated in the same manner as fresh fish.

Composition and Nutritive Value. Fish resembles other flesh foods, being rich in protein. The amount of fat varies in fish. In some species, it is present in the liver; in others, it is distributed throughout the flesh. Vitamins B and G are present to an appreciable extent. The presence of certain minerals also adds to the nutritive value of fish. However, the old idea of fish as a brain food, because of the phosphorus present, is not well founded, as other foods, particularly meat, are equally high. Fish from the sea is, however, a rich source of iodine. The softer bones of some fish may be eaten for their mineral content. Oils from the livers of various fish as cod and halibut are high in vitamin D value.

Shellfish are a source of protein but not fat and, unlike other animal foods, contain a carbohydrate, known as glycogen or animal starch, in quite appreciable amounts. Oysters rank next to liver in iron and copper content. Generally, shellfish seem to be higher in mineral value than most meats. Fish roe, sardines, codfish, and whiting are good sources of thiamin.

Fish Cookery. The object in cooking fish is to improve flavor, coagulate the protein, and retain the form of the fish. The retention of shape is a problem in fish cookery, probably because of the small amount of connective tissue that disintegrates easily, causing the fish to fall apart. Any method applicable to the cooking of tender meats is suitable for fish. Short

cooking at moderate temperature gives the best results. Fat fish may be broiled, steamed, or boiled, but the third method is not too economical because of the resulting loss in weight. Lean fish, as well as fat, may be fried, larded, and baked, or buttered and broiled.

Place in the Diet. Greater use of fish as a source of food could probably be made in most homes. During scarcity or high meat prices, it becomes an important meat substitute. One hundred species are known to be usable as foods. Fish is in the market during the entire week, so its use need not be limited to Fridays. More varieties are available toward the end of the week when the demand is greater. With fish as the main course or dish of the meal, special attention needs to be given to the remainder of the meal with regard to good combinations of flavor, color, and texture.

Digestion. Fish is considered easy to digest, perhaps easier than meat, doubtlessly because of the shortness of the fibers, the lack of connective tissue, the absence of fat in many cases in the interstices, and the easier penetration by digestive juices. Because of the lower fat content, the leaner fish may be even more easily and quickly digested than the fatter varieties.

Some kinds of shellfish seem easy to digest, others more difficult. Because of individual allergies, some persons may suffer severe gastrointestinal disturbances after eating shellfish. The idea that fish, and especially shellfish, cannot be eaten in the same meal with ice cream is unfounded.

Preservation. Various methods of preserving fish, as drying, smoking, pickling, salting, and canning, have long been in use, but, at present, freezing is probably the most widely used because frozen fish is more like the fresh and digestibility is apparently not affected in any way. The rapid rate at which the sale of canned fish is increasing would indicate that the former prejudice against its use is fast being overcome. No doubt the reason lies in the improved commercial methods of canning and the almost complete retention of flavor and nutriment. Canned fish is also more economical because so much of the refuse is eliminated before canning. As it may be obtained at all times and often far from the source of production, it has made people familiar with hitherto unknown varieties. Cold storage for long periods of time is not possible for fish as it is for meat.

QUESTIONS AND ACTIVITIES

1. Of what importance is meat in the diet? How do muscle meat and organs compare in nutritive value?

2. List all the tender cuts of meat, the tougher cuts.

3. Describe the two general methods for cooking meats. For what cuts may each be used and why?

4. Look up recipes for cooking the tougher but less expensive and equally nutritious cuts of meat.

5. Keep a record of the meat purchased by your family for a week. What suggestions can you make to reduce the amount of money spent for meat?

6. Meat contains a complete protein, but the gelatin formed by moist heat from the collagen in the connective tissue is an incomplete protein. What is the meaning of this?

7. What characteristics will you look for in purchasing poultry?

8. In what ways does the cooking of poultry compare with that of meats? Contrast?

9. What characteristics will you look for in purchasing fish?

10. Look up recipes for the different kinds of meat alternates (dishes which can be used in place of meat in the diet).

11. When it is necessary for some reason to omit meat in the diet, how can you make up the iron, thiamin, and riboflavin furnished by the meat?

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CHAPTER XIV

EGGS

Eggs as an Article of Food. The production of eggs in the United States has increased since the beginning of the century. Eggs have long been a staple article of commerce, and egg consumption in the United States is relatively large. Eggs are produced on more farms in this country than any other agricultural commodity. Average consumption of eggs by families appears to be about one dozen and a half per week.

Structure of Eggs. Structurally, the egg consists of shell, white, yolk, and membranes. The shell, which may be white or brown, depending upon the breed of the hen, is composed principally of carbonates and phosphates of lime. It is porous in nature, which decreases the keeping quality because of the loss of moisture and the exchange of gases. Just before the egg is laid, a film which seals the pores of the shell is deposited on it. This minimizes great losses of moisture and is the reason eggs should not be washed until just before using.

Just inside the shell is a double membrane consisting of the outer-shell membrane, closely attached to the shell, and the inner-shell membrane or the one which envelops the white and the yolk. The inner one adheres to the outer one except where the air space forms; this space develops as the egg cools shortly after it is laid. Just within the inner-shell membrane are several layers of white of varying degrees of density. Another membrane, called the vitelline membrane, surrounds the egg yolk, which is spherical and has a germinal disk or embryo on one side. Twisted and thickened strands of albumen known as chalazae are attached to either end of the vitelline membrane for the purpose of holding the yolk as near as possible to the center and allowing the yolk to revolve so that the germ spot always remains uppermost. The structure of an egg is shown in Figure 32.

Quality in Eggs and Factors Affecting It. Freshly laid eggs vary in quality because of the period of the laying cycle, the individual hen producing the eggs, the season of the year, and the food given the hen. Little about the interior quality of an egg can be told by examination of the exterior. Dirty-shell eggs and cracked eggs are easily contaminated, but eggs used soon after receipt are satisfactory and may often be obtained at a lower price. In absolutely fresh eggs, the contents very

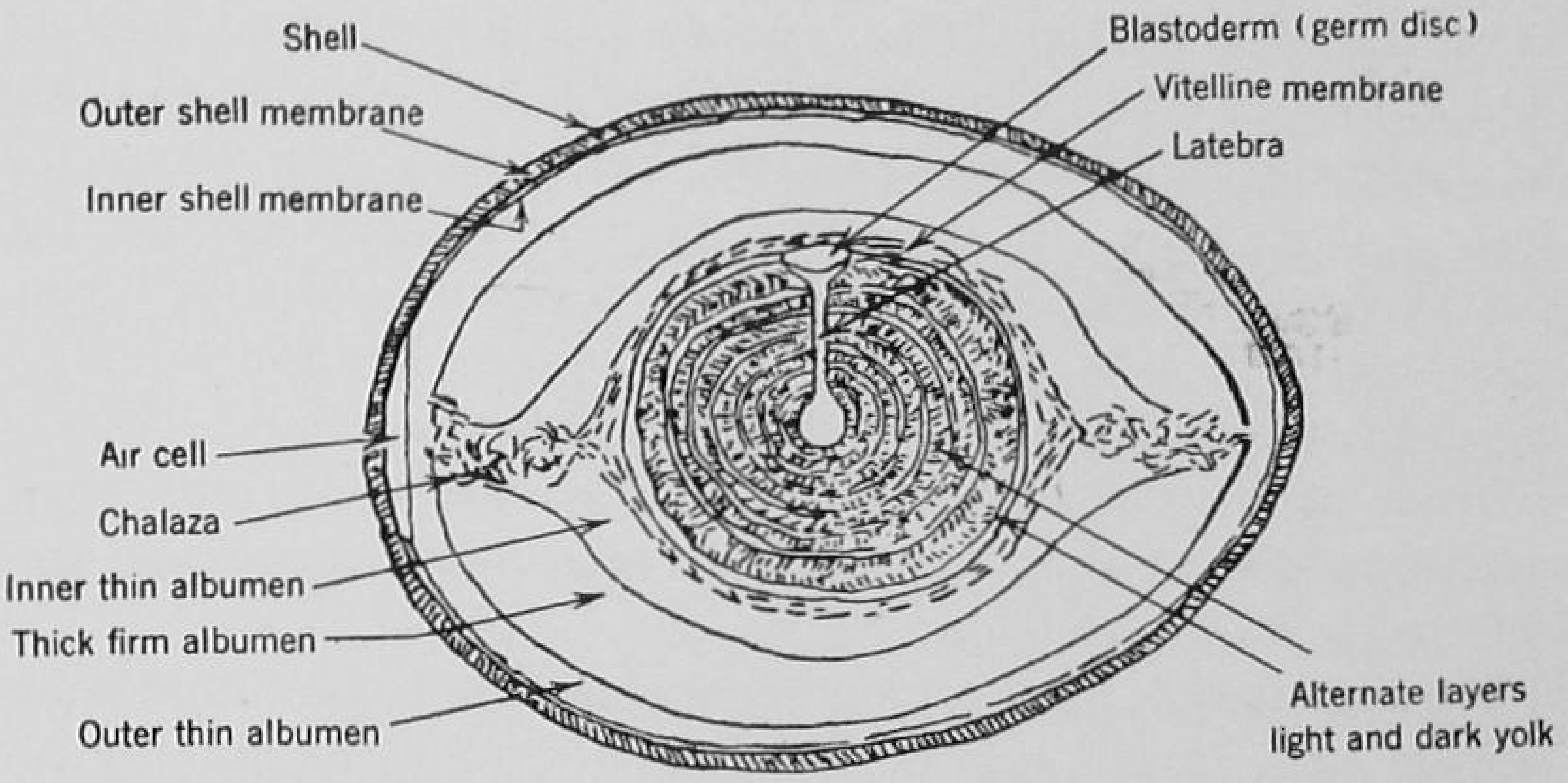

FIG. 32. Cross-section of an egg (diagrammatic). Courtesy, Dr. G. O. Hall, Cornell University.

nearly fill the shell, and the white is jelly-like in consistency and free from bacteria. As soon as the egg is laid, the moisture begins to evaporate through the porous shell, gradually increasing the size of the air space that develops inside, between the two membranes, as the warm egg cools off. As the evaporation continues, this space fills with air. The size of the air cell gives a rough estimate of the amount of deterioration which has taken place. As the air cell increases in size, carbon dioxide is lost, an increase in alkalinity takes place within the egg (which in turn causes further deterioration), the yolk flattens, and the white becomes watery. Microorganisms cause the egg to spoil.

Freshness of eggs is determining by candling. Candling consists of holding the egg before a bright light and noting the appearance of the contents. By means of candling the depth of the air cell, the position and appearance of the yolk, and the state of the white can be observed.

When the egg is broken and removed from the shell, the yolk should stand up round and firm, and the albumen should be almost transparent and should stand up firm around the yolk. The chalazae are firm, twisted very hard, and relatively close to the yolk. The middle layer of the albumen surrounds the yolk closely. There should be no cloudiness or color in the albumen. No off flavors or odors should be apparent.

To insure getting eggs of good quality, purchase them from a reliable dealer who keeps his eggs in a refrigerator, and refrigerate them on arriving home. Eggs are a delicate food product and should be kept in the refrigerator or a cool place at all times at a temperature between 45 and 60° Fahrenheit, even if kept for only a short time. It is difficult to impress upon grocers the necessity of keeping eggs refrigerated at all times. In the home, eggs should be kept away from foods with strong odors. They should not be washed before being placed in the icebox. A comparison of the appearance of eggs, prepared in various ways, which have been kept under proper and improper storage conditions, is shown in Figure 33.

How to Buy. Eggs are marketed generally as fresh and cold-storage eggs. Fresh eggs are considered those of recent production and not held under refrigeration for a period in excess of twenty-nine days. Cold-storage eggs are eggs held under special storage conditions beyond this time at a temperature around 30° Fahrenheit.

Official federal grades for eggs include U. S. Specials or U. S. Grade AA; U. S. Extras or U. S. Grade A; U. S. Standard or U. S. Grade B; and U. S. Trade or U. S. Grade C. Grades are based on the appearance and soundness of the shell, the depth of the air cell, the position and appearance of the yolk, and the firmness and clearness of the white, all determined by candling. Few of the top grade are on the market, the best ones usually being U. S. Grade A. These are suitable for any purpose. Most of the eggs available are of the U. S. Standard quality and are suitable for any cooking purpose.

Eggs are also graded for size, each grade being found in the following sizes: large, weighing about 24 ounces to the pound; medium, 20 to 21 ounces per pound; and small, 17 to 18 ounces to the pound. It has been suggested that purchasing eggs by the pound might be advantageous. In some sections of the

country brown eggs are preferred to white ones and bring a higher price; in other sections, the reverse is true. The food

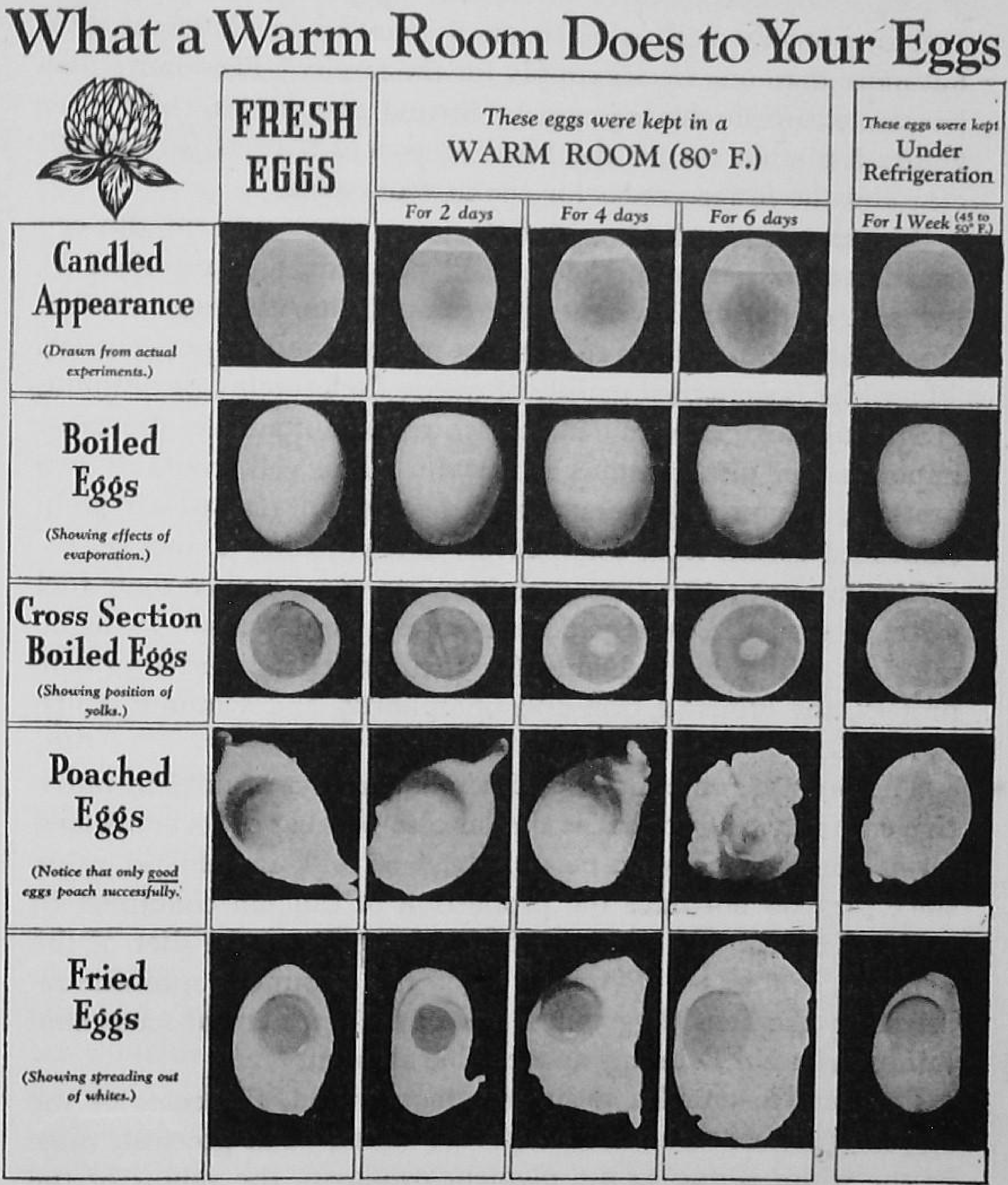

FIG. 33. Why proper handling of eggs is important. Courtesy, Swift and Company, Chicago.

value is the same for both brown and white eggs, providing the hens have been fed the same type of food.

Some states use the federal grading standards; others, their own. Ten states require egg grading. Some states have fresh-egg laws which require that any eggs called fresh shall have an

air space of a designated size, ⅛ or ¼ inch. Other states have model-egg laws, requiring that all eggs labeled fresh must be graded A, B, or C, and the grade made known to the purchaser.

It is probably well to make small-quantity purchases of eggs, not more than one week's supply for the family. Economies may be effected in purchasing eggs by buying two grades, the higher grades for table use in the form of poached, fried, scrambled, etc., and the lower grades for cooking purposes.

Composition and Nutritive Value. The white of the egg constitutes 57 per cent, the yolk 32 per cent, and the shell 11 per cent of the total weight. In composition, the egg averages about 75 per cent water, 13 per cent protein, and 12 per cent fat. The white is composed mainly of water, the proteins, ovalbumin, ovoglobulin, and ovomucin, of which ovalbumin is the most important; it also contains riboflavin. The yolk contains two proteins, the principal one being ovovitellin (fat which is in emulsified form), iron, phosphorus, and vitamins A and D.

Eggs are not to be depended upon for energy, since their fuel value is low; the average-sized egg yields only about 75 to 80 calories. They are valuable for their excellent and complete protein, the minerals iron and phosphorus, and vitamins A, D, B, and G.

The protein content of eggs is similar to that of milk in nutritive efficiency, and the fat is similar also because of its emulsified form. Eggs compare to meat instead of milk in mineral value since they do not have the proportion of calcium contained in milk. The vitamin content of eggs depends on the diet of the hen and, in the case of vitamin D, on the amount of sunshine received by the hen. Egg yolk is one of the few natural foods containing vitamin D in any appreciable amount.

Contrary to an idea rather commonly held, the color of the egg shell has no relation to nutritive value. The greenish tinge of the white is due to the pigment ovoflavin, the yellow of the yolk to a carotinoid. The depth of color in the yolk is due to the amount of green and yellow foods in the diet of the hen.

Because of the sulfur in the white of the egg, eggs are among the acid-forming foods and resemble meat in this respect. The objectionable odor of eggs that have undergone putrefaction is caused by the hydrogen sulfide gas formed during the stages of putrefaction.

Place in the Diet. For good nutrition, it is suggested that one egg daily is desirable. When this is not possible, at least three to four a week should be included in the dietary of the adult and four to five in that of a child. In some form (as egg desserts or main dishes) they should appear in the family dietary every day. Eggs are protective foods because of their excellent mineral and vitamin content and, particularly, their vitamin D value, not generally found in other natural food sources.

Dietary studies indicate that the family income as well as the number of members in the family affects egg consumption to a great degree. At low-cost income levels, eggs are probably a better investment nutritionally than meat, and their iron content is valuable in supplementing the small amount present in milk. Modern pediatric practice approves the addition of egg yolk to an infant's diet early during the first year because of the iron content.

Two eggs make the following contributions to the daily diet of the moderately active man: 17 per cent of his total daily requirement for protein, 7.2 per cent of calcium, 23 per cent of iron, 29 per cent of vitamin A, 8 per cent of vitamin B_1, and 12 per cent of riboflavin.

When eggs are not available in the desired amounts or are too high in price, more milk and green vegetables are important to replace the iron and vitamins A and G content of the eggs.

Egg Cookery. *Uses of Eggs in Cookery.* Besides providing nutritive value, flavor, and color in foods, eggs are valuable in combining ingredients. Their value in this respect lies in the quantity of protein (albumen) present in colloidal form. Eggs are valuable in cookery in the following ways: as thickening substances in liquids, custards, sauces, pie fillings, and boiled dressing; as leavening agents in cakes, soufflés, and omelets; as binding and coating substances in croquettes, cookies, and muffins; as a basis for the elastic framework in popovers; as the clarifying or enmeshing of suspended materials in clearing soups and coffee; and as emulsifying agents in mayonnaise dressings. Eggs also improve the texture of many products.

Coagulation of Protein by Heat. Egg white is a solution of protein (albumen) in water, whereas the protein of egg yolk (ovovitellin) is dispersed around the fat globules to form an

emulsion. Both these proteins are coagulated by heat and at a temperature below 194 degrees Fahrenheit.

Regardless of the method used in egg cookery or the way in which eggs are combined with other foods, the following additional points must be kept in mind: eggs and egg dishes cooked slowly at low temperatures are more tender; high temperatures toughen the coagulated proteins; overcooking, even at a low temperature, will produce a tough, dry product; overcooking of dishes in which liquid is added to the eggs will cause the liquid to be expressed, resulting in a curdled mixture.

Cooking Eggs. Eggs cooked in the shell should be cooked only slightly above the coagulation point for uniform texture to prevent shrinking and toughening. Eggs cooked at a high temperature for a long time may form hydrogen sulfide, a gas that comes in contact with the iron of the yolk and, in turn, forms ferrous sulfide, which gives a green discoloration at the surface of the yolk. If cooled quickly, the color will diffuse to the outer surface and be less noticeable. Cooking at simmering temperature and cooling quickly reduce the tendency of the shell membrane to stick to the eggs and make shelling difficult.

When poaching eggs, drop them into boiling water and reduce the heat. The addition of salt, vinegar, or lemon juice to the boiling water or swirling the water vigorously with a spoon before dropping in the egg will make for a better-shaped poached egg.

When frying an egg drop it into fat hot enough to coagulate the egg quickly for good shape and then reduce the heat. Scrambled eggs should be cooked at low heat or in a double boiler. The principle of low heat is also followed in the cooking of omelets and baked eggs.

Eggs as Thickening. Coagulated protein will hold liquid in a jelly-like state. A definite quantity of egg to liquid is necessary for an optimum jelly. If this mixture is cooked without stirring, as in baked custards, it will set in one piece; if stirred, a viscous fluid is formed, as in soft custard. The mixture coagulates more easily if stirred, because of the mechanical agitation. Mixtures of eggs and milk must be cooked just long enough at moderate temperature to form a jelly; at a high temperature, they shrink and become watery and, in baked custard, are called "weepy."

When using egg in a starchy mixture, as in puddings or pie fillings, it is necessary to cook the starch mixture before adding the egg, as the thickening of each occurs at a different temperature.

Eggs as Leavening Agents. When egg whites are beaten, they foam, as the air bubbles formed are surrounded by coagulated protein. Such a change is due to the low surface tension of the white and the stability of its surface films. The protein coagulates because of the mechanical agitation and gives rigidity to the foam. Fat decreases the foaming quality of egg white, a very small amount on the egg beater interfering with the beating of the white. Salt, sugar, and acid increase the volume and the stability of the foam and, when used for this purpose, are added at the foaming stage or before the whites are completely beaten. Acid also increases the volume by making the protein more elastic and capable of holding more air bubbles. For this reason, part of the sugar is added at the foam stage in making sponge and angel cakes.

Contrary to the usual idea, egg whites at the temperature of the room beat more readily than those taken from the refrigerator because the surface tension of the whites is lowered with higher temperature. Also, the more viscous the egg white, the longer it takes to foam; but the stability is greater. A flat beater, used for beating eggs on a shallow plate, allows larger air bubbles to be formed and also a greater volume, while a rotary beater gives a finer foam of less volume. When combining beaten egg whites with another mixture, as in a cake or soufflé, cover the foam with the mixture in order to prevent the loss of some of the air, as it escapes into the mixture rather than to the outside. Acid has a tenderizing effect on egg proteins as is seen in using tomatoes with omelets or fruit juices in fruit whips.

Eggs as Emulsifying Agents. Egg yolk is more efficient than either the egg white or the whole egg in forming such permanent emulsions as mayonnaise. This property is thought to be due to a compound of protein with lecithin found in the yolk, a lecithoprotein. In mayonnaise, the oil is dispersed in globules throughout the liquid portion. The oil will not stay in globules but will run together unless each oil globule is surrounded by some substance which will cling to the surface. If a substance like egg yolk is absorbed on the surface of the oil globules, they

will not run together and the resulting emulsion is permanent. Eggs act in the same way in other cooking emulsions as they do in cakes and cream puffs.

Digestibility. Eggs are easily and completely digested. The once-debated question of whether raw or cooked egg is more digestible seems to have been settled in favor of the cooked. The method used in cooking does not seem to influence the completeness of digestion although it may influence the length of time required. Soft-cooked eggs are digested in a shorter time than hard-cooked eggs. Eggs slightly cooked at a temperature below that of boiling water are more easily digested than those cooked at a higher temperature, as moderate heat makes the albumen tender and jelly-like whereas high heat makes it tough, dry, and hard, in which condition it offers more resistance to digestive juices.

Preservation of Eggs. *In the Home.* Small quantities of eggs may be kept in the refrigerator or other cool well-ventilated places for short periods of time. For longer periods, they are occasionally stored in a chemical solution, sodium silicate, popularly called water glass, or dipped into an oil without flavor or odor. Both these methods close the pores of the shell and prevent the evaporation of moisture. Eggs treated commercially by the latter method are called shell-treated or processed eggs. Packing in salt may also be used for preserving eggs for home use. Bran and sawdust have been used in place of salt but the danger of their becoming moist and the flavor of the eggs being injured has to be guarded against so their use is not recommended.

Commercial. Cold Storage. Since nearly one-half of the total egg production in the United States occurs in the months of March, April, May, and June, some means is necessary for preserving them from the surplus season to the under-production season. Of all media previously tried for keeping eggs, cold air has been found most satisfactory. The use of cold storage began about 1890. In the cold storage of eggs, the temperature, humidity, and ventilation are carefully controlled. In some instances, carbon dioxide is introduced into the storage room to retard deterioration of eggs. Eggs may previously be oil dipped to prevent the loss of moisture and decrease the rate of carbon dioxide loss. During recent years, eggs held in cold storage

have averaged approximately 7½ million cases (30 dozen eggs to the case) at the peak of the storage season.

For all practical purposes, cold-storage eggs may be used in the same ways as fresh eggs except that the flavor which develops after three to four months may not be as desirable as that of the fresh product. There is little difference in cooking and in the nutritive value except that they do not soft-cook or poach as satisfactorily because of the thinner characteristics of the whites.

Freezing. The extensive freezing of eggs has come about for several reasons, such as the lower costs of packing, storage, and transportation because of the condensed nature of the product and less danger of spoilage during storage. Originally only broken and cracked eggs (considered a waste product) were frozen. Later it was found that the eggs could be profitably marketed in frozen form and sold in quantity to large bakeries and manufacturers of mayonnaise dressings. The rapid development of high-grade frozen products has been attributed to the improvement in quality and to the greater demands made for these products by bakeries because of the increase of bakery products over home-baked goods.

Types of frozen eggs include whole mixed eggs, egg whites, and egg yolks. The whole eggs are mixed thoroughly before freezing into a homogeneous mass. Anticoagulants may be added to the yolks before freezing to prevent some undesirable physical effects of freezing on the yolks and to inhibit bacterial and enzymic activity. Proper sanitation is extremely important for a high quality product in the preparation of the eggs for freezing.

The freezing process does not affect the whipping property of egg whites; in fact, a greater volume is obtainable with them than with the fresh whites. They may be substituted for fresh eggs in the following proportions: 1 cup of frozen whites for 8 egg whites; 1 cup of frozen yolks for 12 egg yolks; and 1 cup of frozen whole eggs for 5 eggs. The eggs may be thawed out by placing the container in a refrigerator for 1 or 2 days at a temperature of about 40 to 45° Fahrenheit before opening the container.

Drying. The dried-egg industry is growing rapidly because of the increased demand for eggs in dried form. During drying,

eggs are reduced to approximately one-fourth of their original weight, thirty-six to forty eggs of average size making a pound of the dried product. Forms of dried eggs include flake-dried whole egg, flake-dried yolk, and dried white. The egg whites are fermented before drying so that they may be whipped satisfactorily.

Dried eggs (whole) can be used in all recipes calling for fresh eggs except in mixtures that are not cooked, such as mayonnaise, and where the quality of the final product depends upon the foaming properties of the egg. Better results are obtained with the egg powder if it is first reconstituted to its normal water content. Equal measures of egg and water are used for this purpose. The powder is placed in a bowl, the water added, and the mixture allowed to stand for about five minutes and then beaten with a rotary egg beater until smooth.

The following are approximate equivalents of fresh and dried whole eggs: * 2 T of dried whole egg and 2 T water equal 1 fresh egg, 4 T of dried whole egg and 4 T water equal 2 fresh eggs, 6 T of dried whole egg and 6 T water equal 3 fresh eggs, 10 T of dried whole egg and 10 T water equal 5 fresh eggs.

QUESTIONS AND ACTIVITIES

1. Keep a record for one week of the number of eggs used daily by your family. Does this amount allow approximately one egg per person per day? Why do you think every person should have one egg daily?

2. What precautions should be taken in cooking or baking dishes with eggs in them?

3. Look up ways in which eggs may be combined in dishes served at the family meal.

4. Does your grocer sell graded eggs? Does he keep his eggs in the refrigerator?

5. Does your state have fresh-egg laws or grading regulations?

6. Cook several eggs in different ways and compare them with the illustrations in Figure 33. What conclusions can you draw about the care which they have received and about their freshness?

* Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

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CHAPTER XV

BUTTER AND OTHER FATS

Foods High in Fats. Fats are obtained from both animal and vegetable sources. The principal animal fats are cream, butter, egg yolk, the fat of beef, mutton, pork, and bacon, bone marrow, chicken fat, and cod-liver oil. Vegetable fats are those derived from fruits and seeds of plants, as olive oil, cottonseed oil, corn oil, peanut oil, soybean oil, and nut oils.

Fats as an Article of Food. Approximately 100 pounds of fat per year are consumed by the American, providing about one-third of his food calories. Of these total fat calories consumed, about one-third comes from meats and meat products, including lard. Americans spend 8 to 18 per cent of their food money for fats and oils. Certain nations desire and are accustomed to more fats in the diet than others, it being a well-known fact that the diet of the Oriental is lower in fat than that of the Occidental.

The consumption of fats and oils in the United States has steadily increased since the defense program was initiated, more fats being used in recent years until the institution of rationing, than ever before. The curtailment of large imports of fats from war areas has necessitated an increase in the growing of such vegetable oil crops as soybean, peanuts, and flax.

Prior to 1915, about the only vegetable oil used was olive oil. Now many new vegetable oils are replacing the more expensive and less available olive oil in the American diet.

Composition. Fats and oils, the most concentrated of fuel foods, were the first of the organic compounds or foods to have their composition determined. They are made up of the same three elements which go to produce the carbohydrates, but the oxygen is less in proportion to the carbon. This explains the fact that fats yield more energy per gram than carbohydrates do.

Fats are glycerides, formed by the combination of fatty acids with glycerol; the kind of fat is determined by the nature of the

fatty acid. When stearic acid alone is combined with the glycerol, the simple fat formed by this union is stearin; when oleic is the acid, olein is the result; palmitic acid gives palmitin. Most fats in nature, however, are mixed fats, that is, they contain several fatty acids.

Properties. Fats and oils differ only as to physical state, fats being solid at ordinary temperature whereas oils are liquid. The nature of the predominating fatty acid in the fat determines the state. Stearin, present in appreciable amounts, yields a firm product which melts at a somewhat higher temperature. Palmitin gives a semi-solid fat; olein is always liquid. Palmitin and stearin exist in varying amounts in nearly all fats of animal origin; fats of vegetable origin contain olein principally, although palmitin is also found. The fat in cream is butyrin, a combination of butyric acid and glycerol. Tallow and suet are mainly stearin with only small amounts of olein.

The term "fixed oils" is sometimes applied to the above-mentioned substances, but this means only that they do not volatilize at ordinary temperatures. "Essential oils" are found in such parts of the plants as leaves, seeds, and fruit, from which source they are obtained by pressure or distillation and used as a basis of flavoring extracts. They are also known as the volatile oils because they volatilize or evaporate at ordinary temperatures. In chemical composition, they are unlike ordinary oils.

Kinds of Fats. *Butter.* Butter is made from either ripened or unripened cream and contains a small proportion of milk substances and some water. It is prepared by churning or beating air into cream, the mechanical agitation separating the fat into a solid mass. Butter that is entered in interstate commerce must contain a minimum of 80 per cent butter fat. Coloring and salt are optional additions. Sweet-cream butter is made from unripened cream.

Butter is the most highly prized of the animal fats not only because of its nutritive value but principally because of its palatability. It is made up of about 85 per cent fat, 11 per cent water, and usually 3 per cent salt; if it contains more than 1 per cent casein or curd, it tends to deteriorate quickly. Water also interferes with keeping quality, for it has been shown that, if all water is eliminated, butter will keep indefinitely. It is to the presence of butyrin that butter owes its flavor. Butter is an ex-

cellent source of vitamin A, usually contains some vitamin D, and, of all the animal fats, is the most readily digested.

Butter is the only fat for which the government has set up definite standards of quality. Any producer of butter may avail himself of the government inspection and grading service. Grading is on a numerical basis, the highest grade on the market being 93 and the lowest for edible table butter 89. Only about one-fourth to one-fifth of all butter available on the market scores 92 to 93; the rest scores between 91 and 89. Containers of butter graded 92 or 93 by the government may carry a government certificate of quality, which gives the score and the date of grading. Such butter should remain the same score for several weeks, if properly refrigerated.

Renovated or processed butter is made from butter which was rancid but, by melting it and forcing air through it, had its objectionable odor and taste removed. It is then rechurned with fresh milk and possibly cream. Its production is under license. If properly labeled as required by law, such butter may be used for cooking.

Lard. Lard, the rendered and refined fat of pork, has always been used extensively. It and so-called commercial shortenings make up a large part of the fat in the diet of the people of the United States. Leaf lard is the best grade and is obtained by kettle rendering at low temperature from the fatty tissue surrounding the kidneys; it is available in very limited quantities. Other kinds, sold under many trade names, include the rendered fat from other parts of the animal, the most available being that which is rendered under steam pressure at a higher temperature and then refined.

Lards and lard compounds (or other fats) which contain animal fat and are packaged must be labeled U. S. Inspected and Passed by the U. S. Department of Agriculture, meaning that their purity and wholesomeness are guaranteed under the Federal Meat Inspection Service. The label must also give the true nature of the contents.

Salad Oils. As mentioned above, oils are fats which, because of a difference in the fatty acid make-up, are liquid at ordinary temperature. Corn, cotton seed, olives, peanuts, and soybeans provide the principal market oils, that of the olive being the only unrefined one. Other edible vegetable oils include those

of sesame seed, poppy, palm, rapeseed, and sunflower. Labels on containers of these products must indicate whether the product is a single oil or a mixture and, if a mixture, of which oils.

Olive oil is obtained from ripe olives which have been gathered just before they turn black, for at this stage they contain the maximum oil. The fruit is crushed and the oil extracted by cold pressure. The lighter the degree of pressure, the higher the grade of oil, great pressure giving a second grade. The dark color is removed by letting the oil stand until the sediment settles and then filtering it. The flavor of the oil depends upon the variety and ripeness of the olives as well as upon the temperature and pressure in extraction. If the oil is refined, it is not of as high quality as the unrefined.

Cottonseed oil is used in combination with other fats and as a substitute for the more expensive olive oil. It is probably the most extensively used of all the vegetable oils. The oil, which is extracted from the seeds by pressure, is refined to remove the characteristic flavor. The first oils made from the cottonseed were for illuminating purposes only.

Corn oil, as well as cottonseed, serves as a substitute for olive oil. It was originally a by-product, called maize oil, produced in the preparation of cornstarch.

The demand for peanut oil for the manufacture of margarines and the packing of fish and olives is increasing in the United States.

Coconut oil is now being used particularly in the manufacture of margarines. Its high decomposition point makes it especially acceptable as a medium for deep-fat frying.

Margarines. So-called butter substitutes are designated as margarines. They are made from vegetable or nut oils (plant sources), from oleo (animal sources), or from a mixture of these two. Regardless of whether a single type or a combination, these products, according to law, must be labeled oleomargarine, probably because the first margarines were made with animal fats. Today well over three-fourths of the margarines are made entirely from vegetable oils (mainly peanut, cottonseed, and soybean) so the required oleomargarine labeling is considered obsolete by some.

Margarines are made by churning any of the fats noted above in ripened milk, usually skim milk. If they are made from

animal fats and enter into interstate trade, they must be manufactured under government regulations, the fat being inspected and the preparation supervised by the Bureau of Animal Husbandry. If uncolored, they are subject to a federal tax of one-fourth cent a pound; if colored, a tax of ten cents a pound is imposed. In some states margarines may be still further taxed, sometimes so much that they become unpurchasable. To avoid the color tax, a small capsule of coloring is placed in the package enabling the user to color the margarine, if desired. The majority of states forbid its sale if colored.

Approximately 85 per cent of the oleomargarine produced today is vitaminized up to 9,000 International Units of vitamin A, making it about equal in vitamin A value to average butter. Since it is cheaper than butter, it is valuable in low-cost diets. The manufacture of margarines was legalized by Congress in 1886, at which time taxes were imposed upon it.

Hydrogenated Fats. These fats might be called lard substitutes just as the margarines are called butter substitutes. They are produced from fats, originally oils (usually cottonseed with some coconut, peanut, soybean, sesame), by hydrogenation, treatment with hydrogen in the presence of heat and a catalyst. In the oils the unsaturated fatty acids are responsible for the liquid state and are changed by the hydrogen into saturated fatty-acid fats, producing a plastic fat. The degree to which the hydrogenation is carried is the essential difference between the several hydrogenated fats available under different trade names. Lard is also occasionally hydrogenated.

Compounds. These products are prepared in such a way, from mixtures of animal fats, hydrogenated vegetable oils, or animal and vegetable oils, that they compare in plasticity to lard or hydrogenated fats.

Cream. The fat in cream is in a fine state of emulsion in its natural state. When whipped, it is in the form of an emulsion and foam. Factors affecting the whipping qualities of cream include the amount of fat, at least 20 to 25 per cent being necessary for successful whipping; the age, whipping qualities improving in aged cream; and the temperature, chilling for two hours producing good results. Pasteurization is partially detrimental to whipping. Boiling and homogenization are completely detrimental to it because they disperse the fat into such

small globules that a foam cannot be formed. Protein is also so affected that it cannot stabilize the foam, a necessity for permanency of whipped cream.

Since cream of high enough fat content is off the market for the present, many devices have been suggested for whipping light cream with its lower fat content of top milk. Among these is a solution of sucrate of lime, called viscogen. This supposedly acts as an emulsifying agent, stabilizing temporarily the foam obtained with the lighter cream.

Other Fats. Chicken fat, mutton fat, beef suet, marrow, and meat drippings are other fats which may be utilized in food preparation. Cod-liver oil and halibut-liver oil, while not cooking oils, need to be mentioned for their excellent content of vitamins A and D.

Other Spreads for Bread. Peanut butter or other nut spreads may be used occasionally as a spread for bread in place of the butter or margarine. They furnish some protein in addition to the fat.

Nutritive Value. As most fats are practically or very nearly 100 per cent pure, they are concentrated sources of energy, yielding approximately 4,000 calories per pound. Fats which contain some water, such as butter, suet, and oleomargarine, yield fewer calories per pound.

The primary use of fat by the body is to furnish fuel or heat, only excesses being stored as fatty tissue. It also furnishes certain fatty acids now considered essential for the best skin health. Refined fats do not contain vitamin A, but butter, fortified margarines, and certain fish-liver oils are excellent sources. Vitamin E is associated with the oil of seeds.

In addition to the nutritive values noted, fat provides good flavor, richness, and the staying qualities greatly missed when it is omitted from the diet. With an adequate amount of fat in the diet, the thiamin consumed is more efficiently utilized. By some nutrition authorities, it is felt that adequate fat may lower the need for vitamin B because of this sparing action. Fat also makes possible an increase of calories in the food without too much bulk.

Place in the Diet. In actual practice, carbohydrates can almost replace fats in the diet as far as calories are concerned. For reasons mentioned under the previous section, it is obvious that

this would be undesirable from the standpoint of good nutrition and satisfaction with one's diet.

When butter is scarce, smaller amounts may be extended in various ways, for example, softening the butter and whipping into it either fresh milk or evaporated milk or extending it with gelatin and evaporated milk as described by manufacturers of gelatin. Soft cheese, fortified margarine, or nut butters, already mentioned, are probably the most palatable for spreading on bread, but drippings or chicken and meat fats on bread are most acceptable to some persons. Oils used on green or yellow vegetable salads provide calories for the vitamin A of the vegetables. The mineral oil frequently suggested for dressings for salads provides no food value. Its use is discouraged because of its undesirable effect on vitamin A absorption. Avocados and olives, when they can be afforded, also provide fat in the diet. Well-ripened soft avocado pulp may be used as a spread for bread or toast. A minimum amount of 2 tablespoons of butter or its equivalent is important in the daily diet.

Green and yellow vegetables, liver, whole milk, egg yolk, American cheese, and tomatoes help to make good the vitamin A of butter and fortified margarines when the latter are scarce. Sometimes people lack vitamin A even when butter is not scarce, since they do not eat sufficient green and yellow vegetables or include whole milk in the diet.

Digestibility. Fats are more slowly digested than other foods but none the less completely. The fineness of emulsion of a fat may determine the length of time and ease of digestion and assimilation. Finely emulsified fat, as that in milk, cream, and egg yolk, may have the digestive process completed in the stomach. Those forming a different emulsion and having a higher melting point are not changed until they reach the intestines and come in contact with the bile, which aids in their emulsification and prepares them for the action of the digestive juices.

While the melting point of a fat may have some bearing on the ease of digestion, it appears that, as far as completeness is concerned, only small and therefore insignificant differences can be noted between the various kinds of fats. Butter, lard, olive oil, and cream are between 97 and 98 per cent digested. The softer and more liquid fats and those which melt at or near body

temperatures are practically completely digested and absorbed.

Fats which have been overheated during the cooking process are digested with great difficulty, and foods coated with fats are difficult for the digestive juices to penetrate.

Purchasing Fats. Butter is sold by the brand, and different grades are available in bulk and package form in most markets. Bulk butter should be cheaper per pound than butter sold in pound or units-of-pound packages. It is economical to buy lower-grade butter in bulk for cooking purposes and the higher grade in bulk or package form for table use. Even for table use, some of the lower grades may prove an economy if the more highly developed flavors are not objectionable to the users. The so-called whipped butter is an expensive way to purchase butter. The same results may be accomplished at home by softening the butter and whipping it with a little milk.

Lard and hydrogenated fats are cheaper per pound when purchased in the largest containers possible; this is also true of the various oils, as quart cans prove a better buy than the pint or less-than-pint cans or bottles.

Fats, with the possible exception of the commercial hydrogenated ones which keep well at room temperature, should be stored in covered containers in a cool, dark place and away from odors and flavors. Rancidity of fats caused by improper storage results in a disagreeable flavor and odor and in the destruction of vitamin A.

Cooking with and in Fats. The chief uses of fat in cooking are to give richness and flavor and to act as shortening and as a frying medium. The increased palatability of a food to which even a minimum amount of fat has been added is so generally appreciated that it need only be mentioned.

Fats suitable for pastry making where a plastic fat is desired include lards, compounds, hydrogenated fats, oleomargarines, and oils (for a tender but not flaky crust). Any fat or oil with a good or bland flavor may be used for quick breads. Cakes for which a fat capable of creaming is advantageous may be made successfully with butter, oleomargarine, hydrogenated fats, and mild-flavored lards. Bland fats and oils are better than butter for greasing pans as they are 100 per cent fat.

The following substitutions may be made in using one fat in place of another. One cup plus 2 tablespoons of butter, the

same amount of oleomargarine, or 1 cup plus 1½ tablespoons of hydrogenated fat may be used in place of 1 cup of lard or similar fat without water. Seven-eighths cup of lard or 1 cup of hydrogenated fat may be used in place of 1 cup of butter or 1 cup of oleomargarine.

Care is needed in using fat as a frying medium. Fats, when heated to a very high temperature, slowly decompose with the production of acrolein, a substance having a disagreeable odor and an irritating effect upon the mucous linings of the body. Fats that have been heated to the smoking point also become rancid more easily; the smoking temperature is lowered each time a fat is reheated.

Deep-fat frying, properly done, need have no undesirable effects. Provided the fat is not heated to the extreme temperature of decomposition or that the food is fat soaked, fried food is probably not objectionable for the adult whose digestion is normal. This temperature of decomposition is an important consideration when selecting a fat for frying purposes, that with a high decomposition point being preferable. It is desirable that the cooking temperature of the food be well below that of the smoking temperature of the fat. Cottonseed oil, hydrogenated fats, and lard have higher decomposition points than butter and olive oil, which, therefore, are not satisfactory for deep-fat frying but may be used for pan frying.

The cooking of foods in fat is usually done at a temperature ranging from 360 to 400° Fahrenheit, according to the nature of the article being cooked. A piece of bread 1 inch square will turn a golden brown in 1 minute in a fat which is at the right temperature (370° Fahrenheit) for frying an uncooked mixture, such as doughnuts and fritters, and in 40 seconds when the fat is at the right temperature (400° Fahrenheit) for a cooked mixture, such as croquettes. A covering of egg and bread crumbs protects foods likely to absorb fat during this process of cooking as the egg coagulates readily and, with the crumbs, forms a crust.

A deep-fat kettle, with straight sides, two-thirds full of fat is more satisfactory than the shallow, wide one with slanting sides. A fat that is liquid at room temperature is the one most satisfactory for frying potato chips and other fried foods served cold. Used fats may be clarified by adding thin slices of raw potato,

cooking slowly over low heat for 20 minutes, and straining through cheesecloth.

QUESTIONS AND ACTIVITIES

1. Of what importance is fat in the diet? What percentage of the total calories required per day should come from fat?

2. List the fats from animal sources, those from plant sources. What is the difference in food value between these two groups?

3. What precautions must be taken in the storage of fats and oils? Why?

4. What are some of the important points to consider in using fat as a frying medium?

5. Fried foods are considered indigestible by many persons. How would you account for this? Is there any justification for this idea? Is there any objection to the use of fried foods in the diet if properly prepared? Would you give fried foods to children? To persons with poor digestion? To invalids? Why?

6. Which fat is more easily and quickly digested: pork fat or mutton fat? Bacon fat or beef suet? Cream or bacon fat? Why?

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CHAPTER XVI

SUGARS AND SIRUPS

Sugars as Carbohydrates. Carbohydrates, which include sugars and starches, are among the most important of the foodstuffs as well as the simplest of the organic foods. They may be divided into three groups.

Group 1. Monosaccharides. These are simple sugars that cannot be split into any simpler forms. The principal ones are glucose or dextrose, fructose or levulose, and galactose. Glucose, sometimes known as dextrose or grape sugar, is found widely distributed in nature, especially in fruits and vegetables, and is one of the main constituents of honey. As it is cheaper than ordinary sugar (sucrose), it is often used as a substitute, but, since it is only about two-fifths as sweet, more of it has to be used in order to obtain the desired results.

It is in the form of glucose that sugar appears in the blood and is being burned continually to produce energy. A certain amount of surplus glucose is absorbed from the digestive tract and stored in the liver as glycogen, which can be converted back into glucose when the need for more fuel arises. In the presence of yeast, glucose undergoes fermentation and changes into alcohol.

Fructose or fruit sugar or levulose, as it is called, is only slightly different from glucose and, like glucose, is found in some plants and vegetables and in large quantities in honey. It is the sweetest of all sugars. Galactose is not found free in nature but is a product of the digestion of milk sugar and can also be produced by boiling lactose (the sugar of milk) with acid. It can be converted into glucose by the body and utilized.

Group 2. Disaccharides. These are complex sugars each of which is capable of being split into two simple sugars in the process of digestion or by the action of acids. They include sucrose, maltose, and lactose. Sucrose is the sugar found in cane, beet, and maple sugar and is a combination of the simple sugars,

glucose and fructose. Maltose is formed from starch by the action of acid or enzymes and is made up of two molecules of glucose. Lactose, the sugar found in milk, is composed of galactose and glucose.

Disaccharides cannot be utilized by the body as such, so they are changed during digestion into simple sugars and absorbed as glucose. This change can be effected also by boiling with acid. If these substances are eaten in excess of body needs, the absorption of all the glucose into which they are changed becomes difficult and the lactic acid and gas to which they give rise create digestive disturbances.

Group 3. Polysaccharides. These are complex substances which yield an unknown number of simple sugars. They include starch, dextrin, glycogen, cellulose, inulin, gums, and pectins. (Starch was discussed in Chapter XII.)

Sugar as an Article of Food. In 1823, the per capita sugar consumption in this country was estimated at 8.8 pounds or about 44 calories per day. A century or more later the per capita figure rose to 108 pounds per year or 500 calories per day or one-sixth of the total calorie need. Since there appears to be some relation between sugar consumption and dental caries, and dental caries is no insignificant problem in this country, this increased sugar consumption does not represent a desirable trend. It has been further accompanied by a decrease in cereal consumption, most of which was in refined form. This has meant a decrease in the consumption of vitamin B. Since greater sugar intake increases the need for vitamin B, a vicious circle has been established in this increased sugar consumption and decreased whole-cereal consumption. Wartime rationing has brought about a temporary decrease in sugar consumption.

Commercial Sugars. Commercial forms in which sugar may be obtained are familiar and are those made from the sugar cane, sugar beet, and sugar maple. They resemble one another chemically.

Cane Sugar (Sucrose). The larger portion of the sugar supply has always come from the juice of the sugar cane. It is estimated that, in 1943, at least one-half of the sugar came from beets. Some persons believe the cane sugar is superior to that of the beet.

Cane sugar is obtained in a crystalline form from a mixture

of crushed-beet or sugar-cane pulp and hot water. The sugar crystals are then separated from the brown liquor (molasses) and dried. Granulated sugar is highly refined, brown not as much so. Loaf or cube sugar and powdered sugar of two degrees of pulverization are available.

Lactose. This sugar is the one found in milk and is the least sweet and the least likely to ferment of all the sugars. It occurs in the milk of all mammals and can be separated from the whey of milk after the curd has been removed in the making of cheese. It is often recommended in the diet where the nutritive value has to be increased without adding to the bulk of the food, for much more of it can be eaten without ill effects on account of its lower sweetening value and less tendency to ferment.

Corn Sugar (Glucose). Glucose, a form of sugar produced commercially by boiling starch with dilute acid, is used in the commercial production of canned and preserved foods, in the making of candies, and by bakeries. It is also known as cerelose and is only about four-fifths as sweet as sucrose so more of it can be used without excessively sweetening a mixture.

Maltose (Malt Sugar.) Maltose is produced from starch by the action of enzymes and ferments found in the cells of some plants, particularly cereals. The brewer gets maltose from malted grains by the action of yeast. Further fermentation changes the maltose into glucose, which is later changed into alcohol. In combination with dextrin as dextri-maltose, it is used in infant feeding.

Maple Sugar. This sugar is of little commercial importance because of the small amount produced. It is a source of minerals, since it is not refined.

Saccharin. Saccharin is a substance thought by many to be a form of sugar. However, it is in no sense a sugar and possesses no nutritive value. It is a white crystalline coal-tar product which, when pure, is five hundred and fifty times as sweet as cane sugar. It should be used, on the advice of a physician only, as a sweetening agent by those persons who, for some reason, cannot assimilate or should not have sugar in the diet.

Sirups. Sweetening agents in liquid form include molasses, sorghum sirup, corn sirup, honey, and maple sirup.

Molasses or Treacle. Molasses is the liquid which remains after the crystals are removed in the manufacture of sugar. Light molasses is that left after the first crystallization of sugar; dark,

that after the second. Black strap is the very dark, strong molasses left after repeated crystallizations.

Molasses contains some sucrose and uncrystallized sugar, but modern methods or the vacuum process, now used, have lowered the sugar content so that molasses is much less valuable for sweetening than formerly. In molasses, as in honey, there is some mineral content, a fact which makes both valuable, particularly molasses, as sweetening agents on low-cost diets. It must contain not more than 25 per cent water and 5 per cent ash.

Sorghum sirup. This sirup is obtained from the juice of the Chinese sugar cane. It can now be grown in our southern and middle western states as easily as corn and is just as easily crushed. However, it is not used in the production of sugar because the large proportion of invert sugar present makes the crystallization and separation of the sugar difficult. Sorghum sirup has a characteristic flavor and is not liked by everyone. It contains sucrose, glucose, and, like molasses, calcium and iron; it may contain not more than 30 per cent water and 6.25 per cent ash calculated on the dry basis.

Honey. Honey has been defined as the "nectar and saccharin exudations of plants gathered, modified, and stored by the honey bee." It is a mixture of glucose, fructose, and sucrose. It must contain not more than 8 per cent sucrose and 25 per cent water. A slight amount of protein and 1 per cent of minerals are also present. The pleasant and distinctive odor and flavor are determined by the source of the nectar (orange blossom, buckwheat, clover, and alfafa) and is due to the presence of certain volatile oils.

The difference in color (the light color is considered superior to the dark) is due to the characteristic nectars of the various flowers on which the bees feed. Sweet clover is of outstanding value in the production of honey, while that from buckwheat and goldenrod is rather strong. Honey is sold either in the comb or in the form of strained honey. The strained form is more likely to be popular. Crystallization of honey sometimes takes place, more often in the pure form than in the impure product; these crystals can easily be dissolved by heating over hot water.

Because of the presence in honey of the two simple sugars, fructose and glucose, it is more readily absorbed into the blood

stream than cane sugar. It has the added advantage of not easily fermenting. Some persons are under the impression that foods sweetened with honey have fewer calories than those sweetened with other sugars, also, that honey is a "safe" sugar for the diabetic to eat. Both ideas are incorrect.

Adulteration must be guarded against in strained honey, as in maple sirup, for other sirups are often added to cheapen the product. However, the label on any containers which enter interstate commerce must list the ingredients. An unsuccessful attempt has been made to produce honey by feeding the bees sirup and glucose, but they do not thrive and the result is wholly lacking in flavor.

Corn Sirup. This sirup is made from cornstarch by hydrolyzing it with acid (only partially, as complete hydrolysis produces corn sugar) and contains dextrin, maltose, and glucose. It may be available either as such or in combination with other sugar mixtures in table sirups, as light, which is almost 100 per cent corn sirup, and as dark, to which another sirup has been added.

Maple Sirup. Maple sirup is the concentrated sap of the maple tree and should contain not over 35 per cent water. Higher-grade sirups are the lighter ones, although the darker, more flavorsome ones may be preferred. Maple sirup is frequently mixed with other sirups; if this is done, the label on the container must indicate what the other sirups are.

Composition, Nutritive Value, and Place in the Diet. Sugars are quick energy producers because they are ready for almost immediate absorption into the blood stream where they can be quickly oxidized to yield heat. Theoretically, sugar as such is not absolutely necessary in the diet as all starches are changed into sugar during digestion. Used in small quantities, however, it gives flavor and variety. Too liberal an amount may be a source of trouble, and the excess, converted as it is into body fat, makes for overweight. The iron content of molasses and the mineral content, in general, of molasses, honey, and sorghum sirup make them more desirable sweetening agents on low-cost diets.

The increasing evidence that high sugar consumption is associated with more tooth defects in children as well as the fact that, for too many people, too large a proportion of the daily

calories come from sugar, unaccompanied by protein, minerals, and vitamins, seem to make undesirable our high national consumption of sugar, previous to rationing. Sugar rationing may have far-reaching beneficial effects on the nutritional status of our population.

Sugar Cookery. *Use of Sugar in Cooking.* In addition to its sweetening power, sugar affects food products in other ways. It is the most important constituent of candy and jellies, which cannot be made without it. In frozen mixtures, too much sugar lowers the freezing point to such an extent that freezing may be completely interfered with. In flour mixtures, such as batters and doughs, its influence is noted in the following ways: a small amount has a good effect on the development of gluten, the browning of the product, and the weight of the product, but a large amount produces undesirable effects in each case.

Cooking of Sugar. The hydrolysis of sugar, brought about by boiling sugar and water together, changes the mixture into equal parts of glucose and fructose called invert sugar. Boiling with acid or acid fruits also brings about this conversion. Therefore, it is economy to defer adding sugar, when making acid jams, jellies, and sauces, until near the end of the cooking process.

When subjected to dry heat, sugar changes first to barley sugar and then to caramel, a brown liquid, and finally to carbon. In the caramel stage, it is uncrystallizable, has a very pleasant taste, and is often used for flavoring as well as a coloring agent for soups and sauces. Commercial caramel is sometimes produced by heating glucose with carbonate and chloride of ammonium.

The importance of temperature in boiling sugar and water in candy preparation cannot be overemphasized, for the disastrous results arising from a difference of only a few degrees are but too well known. Sugar thermometers are at the present time so accurate and dependable that, even if they were not as cheap as they are, it would still be economy to possess one.

In the making of candies, two types result because of the nature and manipulation of the ingredients: crystalline candies, in which the sugar crystals should be as small as possible, and non-crystalline, or amorphous, candies, in which the absence of crystals is sought. Fondant and fudge are examples of the former and caramels of the latter type. Requirements for candy making of the crystalline type include the proper concentration of the sugar

so that the final product will be of the proper consistency, neither too hard nor too soft; complete dissolving of all sugar crystals to start with; no stirring while cooking; beating after cooking the sugar mixture to the correct temperature; and the correct temperature for beating (the cooler the mixture becomes, the more viscous it is, the crystals form with greater difficulty, and smaller crystals result).

*Sugar Substitutes.** In using various sweetening agents to replace all or part of the sugar in recipes, certain differences between these products must be considered. Molasses, sorghum, and cane sirups are less sweet than maple sugar, honey, or sugar itself; they require the use of one and one-half times as much sirup to get the same degree of sweetness. Because corn sirup is even less sweet, twice as much is required for an equally sweet flavor. Sirups also add water to the mixtures in which they are used.

In making jams, jellies, preserves, and marmalades, three parts of sugar to four parts of fruit may be used successfully in place of equal weights of fruit and sugar. Half of the sugar may be replaced with honey. Jellies cannot be made successfully without sugar. One-half of the sugar may be replaced with corn sirup in making preserves, but only one-fourth in jellies, jams, and marmalades. Because of the water in corn sirup, the product may have to be cooked a little longer.

In making cakes, cookies, and pies, no more than one-half of the sugar in a recipe should be replaced with a substitute, as a general procedure, if the best results are to be accomplished. Since honey, molasses, and sirups vary in water content, the exact amount of these to be used in place of sugar cannot be stated. The following suggestions may be used as general procedures.

Honey may replace sugar cup for cup, but the liquid in the recipe should be reduced one-fourth to one-half; if medium-thick honey replaces all the sugar, reduce the liquid one-half; if it replaces only one-half of the sugar, reduce the liquid one-fourth. The baking temperature also should be lowered to prevent excess browning and change in the honey flavor.

Molasses may replace sugar cup for cup, but reduce the liquid

* Adapted, "Recipes to Match Your Sugar Rations," *Cornell University War Emergency Bulletin 30.* Consumer Division, Office of Price Administration. May 1942.

in the recipe 1/4 cup for each cupful of molasses used and add 1/2 teaspoon of baking soda. Corn and cane sirups may replace sugar cup for cup but reduce the liquid one-third. Cookies made with these sweeteners are not as sweet as when made with sugar.

One and one-fourth cups of maple sirup may be used for each cup of sugar in a recipe, but the liquid called for should be reduced 1/2 cup for each cup of sugar.

Sorghum sirup may replace sugar measure for measure with a reduction in the liquid by one-third. In addition, add 1/2 teaspoon of baking soda for every cup of sorghum. As this is equivalent to the leavening power of 2 teaspoons of baking powder, enough baking powder must be added to make up the difference in the original recipe. That is, if a recipe calls for 3 1/2 teaspoons of baking powder, the added soda is equal to 2 teaspoons of the baking power, so 1 1/2 teaspoons of the powder are required.

Conserving Sugar. The following suggestions aid in conserving the amount of sugar used. Serve such sugarless desserts as fresh fruits, fruit salads, fruit and cheese, fruit and cottage cheese, and French toast with sirup. Use canned fruit juices for sweetening puddings, sauces, and beverages. Use jams and jellies in frostings, whips, sauces, ice cream, sandwiches, and pie meringues. Add sugar last as a sweetener in cooking fruits. Simple puddings require less sugar than more elaborate ones. Dried fruits may be used without additional sugar in making fruit whips. Cooked fruits served hot are sweeter than when cold. The sweetening power of sugar in some cooked foods is enhanced by a pinch of salt. Learn to like the less sweet foods.

Digestibility. Moderate amounts of sugar in the diet are easily digested. Excesses may be irritating to the stomach and may cause excessive fermentation. Sucrose is changed to glucose by intestinal enzymes before absorption, and this is ready to be absorbed immediately. Lactose ferments less readily in the intestine than does glucose or sucrose.

QUESTIONS AND ACTIVITIES

1. What forms of sugar are generally found in the home?
2. Is it possible for one to get along without any sugar in the diet? Why?

3. Sugars vary in sweetening power and also in their solubility in water. Taste samples of the various sugars for sweetness, and rank according to degree of sweetness. Test the solubility of the various sugars in water, and rank as to solubility.

4. All forms of sugar furnish the same number of calories per unit of weight (4 calories per gram). Which will furnish more calories, an eggnog sweetened with cane sugar or one sweetened with lactose? Why?

5. The use of molasses is often suggested to replace some of the sugar in low-cost diets. How do you explain this substitution?

6. In cooking apple sauce, cranberry sauce or jelly, and stewed fruits, sugar may be added at the beginning or end of the cooking process. Which is better? Why?

7. Why is it undesirable to eat candy or other sweets between or directly before meals?

8. Upon what facts does successful sugar cookery depend?

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CHAPTER XVII

BEVERAGES AND FOOD ADJUNCTS

BEVERAGES

Kinds and Uses of Beverages. Besides serving as a means of introducing water into the system, beverages are often valuable for their stimulating, refreshing, and nutritious properties. Tea and coffee, unless combined with cream, sugar, or milk, can be said to contain no nourishment and so are valuable only for stimulation and the sense of well-being which follows their use. Chocolate and cocoa, made as they are with a milk basis, do furnish nourishment as well as a little stimulation. Fruit juices, notably orange, pineapple, grapefruit, lemon, lime, and tomato, are growing in popularity, especially in summer, and their use is to be encouraged. They contribute not only calories but, in the case of citrus juices, vitamin C as well.

Coffee. Coffee is, perhaps, the most universally used of all beverages in the United States. Brazil produces about one-half of the world's supply and approximately three-fourths of that consumed in the United States. The remainder consumed here comes from Central America. It is the fruit of a small shrub, not unlike our cherry in appearance. Imbedded in the pulp are two beans which have to go through a process of fermentation to facilitate the removal of the very tough skin. It is on the careful roasting of the beans that the fine flavor and characteristic aroma depend. Glazing with sugar often follows to prevent the loss of the aromatic substance, which is a volatile oil called caffeol.

The stimulating effect of coffee depends upon the presence in it of an alkaloid, known as caffein, which is said to act directly upon the central nervous system and, with some people, to diminish greatly the sense of fatigue, increase mental activity, and quicken the power of concentration. If no sense of depression

follows this action, then coffee is not necessarily harmful to that person, but if followed by lassitude its use should be curtailed.

Older persons often find a cup of coffee in the morning very agreeable because of its stimulating effect on the heart as well as on the circulation. A small cup of strong black coffee taken after a heavy meal is said to aid digestion. The fact that some persons find the stimulating effect of coffee without cream to be of shorter duration than that with cream has been accounted for by its rapid absorption, whereas the cream, being fat, retards the absorption and prolongs the stimulation.

Preparation of Coffee. The desired strength of coffee will determine somewhat the method of preparation. Always the main object is to retain all the volatile oil and yet eliminate the tannin. Boiling, percolating, and dripping are the usual methods of preparation. By the first method which, actually, in spite of the name, is carried on below the boiling point (if properly done), a richness that is not found in the percolated product is obtained, but much tannin may be extracted and some of the flavor lost. A temperature between 185 and 200° Fahrenheit is the best for making coffee. Percolated coffee is supposed to contain less tannin than boiled, and drip coffee has been found to have most of the real coffee flavor. Making coffee in the now popular glass apparatus is thought by many to be superior to any other way, as the glass has no effect upon the flavor, as metal may have. Filtering is the term applied to the method utilized with these glass coffee makers.

Café au lait is coffee made with equal parts of hot strong coffee and hot milk poured together, at the same time, into a cup. The resulting product is not unlike coffee with added cream and provides a method of introducing milk and also an economy when cream is expensive. Café noir is strong black coffee.

Food Value of Coffee. Plain coffee has no nutritive value; the caffein in it does have a physiological effect in stimulating the nervous and muscular systems. Although the coffee beans contain less of the stimulating substance than tea leaves, a cup of coffee may have more stimulation because of the method of preparation. Sugar and cream added to coffee provide calories and fat. The idea that the combination of cream and coffee is undesirable is unfounded.

Coffee Substitutes. In this country we consider the addition of chicory an adulteration, but foreigners add it from preference because, after roasting, the color is so soluble that a very small amount of it gives a rich dark color, imparting the impression of a very strong infusion, which, in reality, it is not.

Roasted grains are sold under the name of "cereal coffees." Coffee extracts are made by evaporating a coffee infusion from which coffee may be easily and quickly prepared, but they are expensive and usually kept on hand for emergencies only. "Caffein-free" coffees are now obtainable and used by persons who consider caffein deleterious. They are usually slightly less than 100 per cent decaffeinated.

Tea. Next to coffee, tea is, perhaps, the most popular beverage. It is made from the leaves and leaf buds of an evergreen shrub. All teas may be classed under two headings, black or green, both of which come from the same source, the difference between them arising from the method of curing. The first crop of leaves yields the highest-priced tea. If black tea is desired, the leaves are fermented before drying and then subjected to heat on copper trays just long enough to wither them and permit of easy rolling but not long enough to injure the substance upon which the flavor depends. This process renders the tannin less soluble. In the preparation of green tea, the fermentation process, which darkens the leaves, is omitted and so the infusion is much lighter in color, giving the impression of being much less strong than the black, when, in reality, it may contain a much larger percentage of tannin. China teas are usually green and India black. Oolong teas are semi-fermented.

The familiar terms, flowery orange pekoe, orange pekoe, pekoe souchong, and souchong refer, not to the variety of tea as is ordinarily supposed, but to the size and position of the leaves on the stem of the tea plant. The first are small and tender and highest in quality; the last larger, less tender, and lowest in quality. The above terms are used with teas from India, Java, and Ceylon.

In Chinese teas, such terms as orange pekoe, gunpowder, and hyson are used to indicate size and position of the leaf on the stem.

Food Value of Tea. Unless taken with sugar and cream, tea has no food value, being simply a stimulant, as it holds in solu-

tion only the soluble substances of the leaves, consisting of coloring matter, volatile oil, theine (to which tea owes its stimulating property and which is similar to caffein in coffee), and tannin. The amount of that undesirable astringent will depend upon the length of time the boiling water remains on the leaves: if too long, a decidedly bitter taste will develop. Large amounts of tannin are thought to have an unfavorable effect on digestion. Tea should be brewed with freshly boiled water below the boiling point, as tannin is extracted less slowly at this temperature. A china pot is thought better than one of metal, since some persons believe that the interaction of the metal and tannin may affect the flavor of the tea undesirably.

Chocolate and Cocoa. Both chocolate and cocoa are made from the ripe seeds of the cocoa bean, which are fermented, and the pulp is removed, dried, and roasted. "Cocoa nibs" are the kernels broken in pieces, crushed, and subjected to a temperature sufficiently high to melt them and form a paste which, when cooled, is known as bitter chocolate. For the sweet variety, sugar and flavoring are added. Cocoa differs from chocolate in that much of the fat has been removed by pressure and the resulting product ground to a fine powder.

Food Value of Chocolate and Cocoa. Chocolate and cocoa, containing both carbohydrate and fat, are energy foods. Their stimulating property is due to the presence of the alkaloid, resembling caffein though less potent, known as theobromine. The carbohydrate is present in the form of starch, and, although some of it may be converted into dextrin during the roasting, too great emphasis cannot be placed upon the necessity of the thorough cooking of both before the addition to the hot milk in making the beverage or sirup. This can be most easily accomplished by mixing with the sugar and a little water and boiling directly over the flame for a few minutes.

Gastric disturbances may result from too free a use of chocolate because of the high fat content. Some persons are allergic to chocolate and find its use impossible in any form.

FOOD ADJUNCTS

These substances include flavoring substances, condiments as salt, vinegar, spices, herbs, and coloring matters.

Flavoring Substances. These substances depend, for their value, on the essential oils extracted either by pressure or distillation from fruits, seeds, or leaves of plants. There are a great many different ones, but those most generally liked are vanilla, made from the vanilla bean, lemon and orange, obtained by soaking the peel of these fruits in alcohol which has the power of withdrawing the volatile oil, and almond, made from the seed of the bitter almond, the peculiar flavor of which is the result of the development of prussic acid. The kernel of the peach has a similar flavor.

Synthetic extracts are not obtained from plants but, as the name suggests, are produced in laboratories by combining chemical compound ethers with small amounts of oils and extractives from the plant and coloring from vegetable or coal-tar products. They are so much less delicate that too liberal use of them results in an objectionable, rather than a pleasant, flavor and, with some people, the after-effects are irritating.

Condiments. As many otherwise tasteless foods may be made less insipid and more palatable by the addition of such substances as salt, pepper, vinegar, spices, and flavorings, all classed under condiments, they may be said to be a necessary part of a well-planned diet. Some authorities go to the extent of giving them a place as body regulators, although all that can be accredited to them in this line is their power of stimulating the flow of the saliva and gastric juice by the odor and flavor they impart and thus promoting digestion.

Food Value of Condiments. Substances considered under this heading have no actual food value, but they do add interest to food because of their flavors. Their value as an aid to digestion in tropical countries probably lies in their irritating effects on the mucous membranes of the digestive organs, which frequently become torpid and need a stimulant of some kind to whip them into action. Condiments in large amounts have no place in the diet of children or of persons suffering from stomach or intestinal disorders.

Common Salt (Sodium Chloride). Though usually thought of as a condiment, and justly so, as many foods are utterly tasteless without it, salt may in reality fill a real nutritional need in furnishing sodium and chlorine to the body and in carrying iodine, naturally or artificially, to areas where goiter is preva-

lent. In cooking, especially vegetables which seem to call for more salt than animal foods, it is easy to form the habit of using too much. This should be avoided as it puts too much strain upon the kidneys to eliminate the excess. The fact that in certain diseases the addition of salt is prohibited because of deleterious effects proves that foods themselves contain sufficient of it to satisfy the needs of the body, all the secretions of which contain a trace of it.

Vinegar. When produced by a process of fermentation from substances which are readily acted upon by yeast, such as wine, cider, malt, cane sugar, and molasses, there is no valid objection to the use of vinegar though, at the present time, its place, especially in salad dressings, is being taken by lemon juice. Besides being used as a condiment to give flavor, it is often valuable in making the fibers of meat tender as well as in softening the cellulose of plant products.

Malt vinegar is the product of the alcoholic fermentation of barley and other cereals. Cider vinegar is made from the juice of apples which, on standing, yields acetic acid. Wine vinegar is made from the juice of grapes, the vinegar from white grapes being considered superior to the red. Sugar vinegar is the result of the fermentation of sugar, sirup, or molasses. Tarragon vinegar is the ordinary kind to which leaves of the garden plant have been added for flavor.

Synthetic vinegar, which is a combination of commercial acetic acid with other substances, may, because of its general use and often disagreeable after-effects, be the reason for the universal substitution for it of lemon juice.

Pepper. Pepper is the fruit of a tropical shrub and, when ground unripe, is known as black pepper. When ripe and put through a process of fermentation before removing the black coating and grinding, the variety is known as white pepper, which is less pungent than the black. Cayenne, or red pepper, is the ground pod of a species of capsicum and is very irritating to the mucous membrane if more than a few grains are used. Paprika is made from the ground ripe fruit of the capsicum.

Spices. Spices are valuable for their odor and flavor, which are due to volatile oils, and are prepared from the dried leaves and stems of certain plants. Spices may be divided into those usually connected with meat cookery, such as thyme, marjoram,

summer savory, bay leaf, sage, celery seed, and capers, and those connected with dessert dishes, such as allspice, cinnamon, nutmeg, cloves, mace, and ginger. Ginger appears often in the form of the young roots cooked in sirup or crystallized by boiling in a sugar solution.

QUESTIONS AND ACTIVITIES

1. What foods are usually classed as beverages?
2. Of what value, if any, are tea and coffee in the diet? Is it necessary that they be part of the meal? In what respects are they similar? Who should avoid these beverages? What are the effects of excesses?
3. What is the value of cocoa or chocolate in the diet (beverage)? What is the difference between cocoa and chocolate? How do they compare in food value with other beverages? Do you think children should be allowed unlimited amounts?
4. What is the correct method of making a cocoa or chocolate beverage? Why?

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UNIT THREE

PLANNING FOR GOOD NUTRITION

CHAPTER XVIII

CONSTRUCTION OF ADEQUATE DIETS

Meaning of Adequate Diet. Most persons get a diet which is just sufficient to meet their minimum physiological needs, but there are probably few persons who would not be benefited by a better choice of foods, especially the so-called "protective" foods. With the development of the science of nutrition, much of the research activity has been for the purpose of learning the nutritional needs of human beings, how best to supply them, and how to determine nutritional goals. All of the newer knowledge of nutrition must be applied in the daily selection of foods if an adequate diet, in terms of present-day standards, is to be obtained.

The amount of protective foods consumed makes the difference, in the eyes of the nutritionists, between the usual and the good, or adequate, diet. This is because protective foods reinforce the usual diet where it is apt to be weak, in minerals and vitamins. The usual diet provides enough to eat; hollow hunger is satisfied and there are enough nutritional essentials to maintain the body weight of an adult, provide some growth in children, and keep the person free from disease and in a passable state of health. An adequate diet provides all this plus enough more good quality protein, minerals, and vitamins to bring about the best possible kind of health, vitality, and resistance. It also provides for that hidden hunger or the hunger for the minerals and vitamins, so often missing from that diet, high in calories, which satisfies the hollow hunger mentioned above. Some persons use the terms adequate and optimum for the terms usual and adequate as described above.

Factors Affecting Adequacy of Diet. *Underlying Factors.* A basic factor affecting the chances of getting an adequate diet is the economic status of an individual or family group. With two-thirds of the families in the United States receiving, in ordi-

nary times, incomes of less than $1,500 per year and about one-fourth receiving between $1,500 and $3,000 yearly, it is evident that some families would have difficulty buying the barest food essentials.

Another underlying factor is the approval or disapproval certain racial customs have for individual foods which may be valuable nutritionally as well as available on the market. The fact that diets based on race experience do not necessarily provide for good nutrition is evidenced by frequent comparisons in nutritional literature of the dietary practices of two different groups of people in different parts of the same country. Such comparisons always indicate superiority in muscle strength, height and weight, stamina and efficiency, and absence of disease of the group whose diet contains more of the whole grain products, milk, fruits, and vegetables, and inferiority where these foods are consumed in inadequate amounts. The fact must not be overlooked that, in some instances, racial dietary habits and customs are conditioned largely by geography and other limitations of production.

The typical American dietary has been none too good when evaluated in terms of recent army rejections because of nutritional causes, the high incidence of malnutrition and tooth defects among school children, and the prevalence of the dietary deficiency disease, pellagra, in the South.

Too great consideration for one's personal likes and dislikes probably accounts for dietary inadequacies in far too many cases. Improving nutritional status frequently means learning to like new foods or putting greater emphasis on some foods and less on others, not an impossibility if one is willing to face the problem of his nutrition and health objectively and intelligently. Also, following fads and stressing fallacies, rather than accepting facts, in nutrition leads to undue stress on less important foods or the omission of essential ones.

A basic knowledge of what the body's needs are and a working plan for supplying them are requisite for good nutrition. Random choice of foods and too great a reliance on the appetite to tell one when and what to eat lead to overeating or undereating, in general, or to overeating of the less essential and undereating of the more essential foods, or to eating too much of some nutrients and too little of others. Diet patterns, to be discussed

later, are available as guides in selecting the daily foods which will furnish all the essential nutrients.

More directly, the availability of foods affects, in some instances, the adequacy of the daily dietary. Shortages brought about by transportation, by seasonal and climatic conditions, and, more recently, by war activities bring difficulties in securing many foods considered essential.

The method by which food is handled after production, and especially after it reaches the kitchen, frequently determines final adequacy of the diet, particularly in regard to minerals and vitamins.

Changes in national dietary habits and tastes, as well as in manufacturing processes, may also affect the adequacy of the dietary. The past few generations have seen marked changes in the diet of the people of the United States; some of these have been on the credit side of the nutrition ledger, some on the debit side. Less grain products and meats and more fats, sugar, fruits, succulent vegetables, and milk are consumed, according to the Bureau of Human Nutrition and Home Economics studies in recent years. The proportion of calories that are consumed in the form of milk, cheese, fruits, and vegetables has been doubled in the past fifty years. Fewer calories now come from grains, meat, fats (not butter), sugars, potatoes, and dried legumes. However, the actual percentage of food calories coming from protective foods is only 33 per cent, as compared with the recommended figure of 50 per cent; the percentage of food calories from whole-grain products is less than one-fifth, as compared with the recommended figure of one-half.

What appear to be advantageous nutritional effects of the change in the proportion of calories from different foods are largely offset by the fact that certain manufacturing processes have removed from some foods desirable nutritive qualities. The demand for better keeping quality in foods and whiteness in certain products has led to the extensive milling of wheat and refining of flour, the greater refining of cane sugar, and the bleaching of certain vegetables. The nutritive properties of skim milk have been overlooked in the preference for richer-tasting whole milk and those of the internal organs of animals which may be used as food in preference for the leaner muscle meats. Fortunately, nutrition study has partly remedied this

FIG. 34. Comparative recommended requirements of specific nutrients for men, w

FIG. 34. Comparative recommended requirements of specific nutrients for men, women, and children. From "Know Your Foods." Courtesy, Metropolitan Life Insurance Company.

situation by discovering the high nutritive values of skim milk and internal organs, the relation of vitamin A and the green chlorophyll in plants and plant foods, the encouragement of the production of less highly refined foods, and the promotion of an enrichment program.

Standards for an Adequate Diet. The table of Recommended Daily Allowances for Specific Nutrients, issued by the Food and Nutrition Board of the National Research Council, is referred to as the Yardstick for Good Nutrition and is reproduced as Table 9, page 19. It lists nutrients and the amounts of them currently considered, by nutrition authorities, to be indispensable to good nutrition. The "Basic Seven" Food Chart (see Figure 6, page 20) offers a daily pattern for an adequate diet. It conforms to the recommended allowances and takes into account the necessity of using alternate foods with the same nutritive value when certain commonly used foods are scarce, rationed, or unobtainable. This chart thus provides much leeway for any present necessary war adjustments.

Figure 34 shows the food needs of persons of different sex, age, and activity. The bars in the charts indicate the number of shares of each nutrient needed by the body.

Diet Plans That Meet the Dietary Allowances. The following diet plans are suggested by the Food and Nutrition Board. As noted at the bottom of the plans, there are many other combinations that will cover the allowances.

Diet Plans That Meet the Dietary Allowances *

In using the recommended allowances it should be emphasized that the amounts of the various nutrients provided for in these recommended allowances, with the exception of vitamin D, can be obtained through a good diet of natural foods, including foods like enriched white flour and bread which have been improved according to recommendations of the Board.

The safest way to insure that the dietary allowances are met is to include certain foods in the diet daily in specified amounts. One dietary pattern which contains a variety of foods commonly available is given on page 244.

* "Recommended Dietary Allowances," *National Research Council Reprint and Circular Series Number 115,* January 1943. Courtesy, National Research Council.

List I

Milk	1 pint
Egg	1 daily, if possible. (On days not used, beans, peanuts, cheese, or more milk or meat to be used instead)
Meat, fish, or fowl	1 or more servings
Potato	1 or more
Vegetables	2 or more servings. One green or yellow
Fruits	2 or more. One citrus fruit or tomato or other good source of vitamin C
Cereals and bread	Whole-grain or enriched
Other foods as needed to complete the meal	

This list is based on the needs of the average adult. For children the milk needs to be increased, but the kinds of foods to include remain the same.

Another list using less milk and lean meat is given as illustrative of the varied ways in which the allowances may be met.

List II

Turnip greens	1 cup
Sweet potatoes	3
Peanuts	20 nuts or 2 tablespoons of peanut butter
Beans or cowpeas	1½ oz.
Tomatoes	1 cup
Cornmeal	3 oz.
Enriched flour	3 to 4 oz.
Milk (fresh, evaporated, or dried)	⅓ qt.
Lean pork	small serving 3 to 4 times a week
Molasses, fat, etc., to complete the meals	

Calculations show that both these lists meet the dietary allowances. It should be pointed out, however, that every food is needed in the amounts specified. If any food is omitted, therefore, it should be replaced by another of equal value.

There are many other combinations of foods that will also cover these allowances. It is expected that nutrition workers in various parts of the country will translate these allowances into appropriate quantities of foodstuffs available in their localities and suited to the income level of the group concerned. Such allowances, expressed in terms of everyday foods, can then be widely used in practical nutrition work.

Changes Necessitated by Shortages in the Food Supply. Due to the fact that the whole food picture in the United States has changed, as a result of war activities, from one of abundance to one of relative scarcity and that certain shortages have developed in the supply of some foods habitually consumed, modifications

may be necessary in the recommended daily allowances. The Food and Nutrition Board has suggested that, for the purpose of calculating diets in an emergency, 70 per cent of the figures in Table 9, page 19, may be used.

Major Food Groups. The Bureau of Human Nutrition and Home Economics early classified the common foods in this country into a dozen groups. More recently, one of the groups was eliminated by combining butter with other fats. Eggs stand alone in one group, but in some groups there is a long list to choose from, of foods similar in food value and often used in the same way in meals. The eleven food groups include: milk or its equivalent in cheese, evaporated milk, or dry milk; potatoes, sweet potatoes; dry beans, peas, nuts; tomatoes, citrus fruits, and other foods rich in vitamin C; leafy, green, and yellow vegetables; other vegetables and fruits not mentioned above; eggs; lean meat, poultry, fish; flour, baked goods, and assorted cereals; fatty foods, as butter, margarines, lard, oil, vegetable shortening, salt pork, and bacon; sugars, including jams, jellies, honey, sirups, and molasses.

Family Diet Plans. As mentioned previously, recommended allowances on the Yardstick for Good Nutrition (see Table 9) are given in terms of calories, protein, calcium, iron, etc., to be furnished by natural foods of the right kinds and amounts. To be practical, these dietary allowances must be translated into quantities for the homemaker to include in her daily meals. This was done in 1943 by the Bureau of Human Nutrition and Home Economics in two sets of family food plans, one at low cost and the other at moderate cost.* These food plans are shown in Tables 28 and 29.

What the Food Plans Are. Each of the family food plans is outlined in terms of the major food groups previously described, and not in individual foods, and is flexible enough to fit any season, any place, and any family food taste. This makes possible the use of the plans in any part of the country, drawing upon local markets and home-produced foods.

Both plans take into account probable supplies and ration allowances. Either one will provide foods that will furnish the

* *Family Food Plans for Good Nutrition,* Bureau of Human Nutrition and Home Economics, United States Department of Agriculture, December 1943.

TABLE 28

FAMILY FOOD PLAN AT LOW COST *

Family Members	Milk †	Potatoes, sweet potatoes		Dry beans and peas, nuts		Citrus fruit, tomatoes		Green, yellow vegetables		Other vegetables and fruit		Eggs	Meat, poultry, fish		Flour, cereals ‡		Fats and oils		Sugar, sirups, preserves	
Kinds and Quantities of Food for a Week																				
	Qt.	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*No.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*
Children under 12 years:																				
9–12 months	7	0	8			2	0	1	8	0	8	5	0	2	0	8	0	1	0	1
1–3 years	5	1	0			1	12	1	8	1	0	5	0	8	1	8	0	4	0	2
4–6 years	5	1	8	0	2	1	8	1	8	1	8	5	1	0	2	0	0	6	0	8
7–9 years	5	2	8	0	2	1	8	1	8	2	8	5	1	8	2	8	0	10	0	8
10–12 years	6	3	0	0	2	1	8	1	8	2	8	5	2	0	3	4	0	12	0	10
Girls:																				
13–15 years	6	3	8	0	4	1	12	1	8	2	8	5	2	0	4	0	0	14	0	10
16–20 years	5	3	0	0	4	1	12	1	8	2	8	5	2	0	3	8	0	12	0	10
Women:																				
Moderately active	4½	3	0	0	6	1	8	1	8	2	8	4	2	0	3	8	0	12	0	12
Very active	5½	4	0	0	12	1	8	1	8	2	8	4	2	0	4	12	1	0	0	12
Sedentary	4½	2	0	0	4	1	8	1	8	2	8	4	2	0	2	8	0	12	0	12
Pregnant	7	2	0	0	6	2	0	2	0	2	8	6	2	5	3	0	0	12	0	10
Nursing	10½	4	0	0	6	3	0	3	0	3	8	6	2	5	3	0	0	12	0	10
Boys:																				
13–15 years	6	4	0	0	8	1	12	2	0	3	0	5	2	0	5	0	1	2	0	12
16–20 years	6	5	0	0	12	1	12	2	0	3	0	5	2	0	7	0	1	6	0	12
Men:																				
Moderately active	5	4	0	0	12	1	8	1	8	2	8	4	2	0	4	12	1	0	0	12
Very active	6	7	0	1	0	1	8	1	8	2	8	4	2	0	9	0	1	10	0	12
Sedentary	5	3	0	0	6	1	8	1	8	2	8	4	2	0	3	8	0	12	0	12
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Total										.....		..	.....		.....		.....		.....	

* *Family Food Plans for Good Nutrition.* Reprinted by courtesy of the Bureau of Human Nutrition and Home Economics.
† Or its equivalent in cheese, evaporated milk, or dry milk.
‡ Count 1½ pounds of meal as 1 pound of flour.

TABLE 29

FAMILY FOOD PLAN AT MODERATE COST *

Family Members	Milk †	Potatoes, sweet potatoes		Dry beans, and peas, nuts		Citrus fruit, tomatoes		Green, yellow vegetables		Other vegetables and fruit		Eggs	Meat, poultry, fish		Flour, cereals ‡		Fats and oils		Sugar, sirups, preserves	
Kinds and Quantities of Food for a Week																				
	Qt.	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*No.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*	*Lb.*	*Oz.*
Children under 12 years:																				
9–12 months	7	0	8			2	0	1	8	0	8	5	0	2	0	8	0	1	0	1
1–3 years	5	0	8			1	12	2	0	2	0	6	0	8	1	4	0	4	0	2
4–6 years	5	1	4	0	1	1	8	2	0	2	0	6	1	0	1	12	0	6	0	8
7–9 years	5	2	0	0	1	1	8	2	0	3	0	6	1	8	2	4	0	10	0	8
10–12 years	6	2	8	0	2	1	12	2	0	3	0	6	2	0	3	0	0	12	0	12
Girls:																				
13–15 years	6	3	0	0	2	1	12	2	0	3	0	6	2	8	4	0	0	14	0	12
16–20 years	5	3	0	0	2	1	12	2	0	3	0	6	2	8	3	0	0	12	0	10
Women:																				
Moderately active	4½	2	8	0	4	2	0	3	8	4	0	5	2	8	3	0	0	12	0	12
Very active	5½	3	8	0	6	2	0	3	8	4	8	5	2	8	4	0	0	14	0	12
Sedentary	4½	2	0	0	2	2	0	3	8	4	0	5	2	8	2	4	0	10	0	12
Pregnant	7	2	0	0	2	2	8	4	0	4	0	6	2	12	2	8	0	12	0	12
Nursing	10½	3	0	0	4	3	0	4	0	4	8	6	3	0	2	8	0	12	0	12
Boys:																				
13–15 years	6	3	8	0	4	2	0	3	0	4	0	5	2	8	4	8	1	0	0	12
16–20 years	6	4	8	0	8	2	0	3	0	4	0	5	2	8	6	0	1	4	0	12
Men:																				
Moderately active	5	3	0	0	4	2	0	3	8	4	0	5	3	0	4	8	1	0	0	12
Very active	6	5	8	0	8	2	0	3	8	5	0	5	3	0	8	8	1	10	0	12
Sedentary	5	2	8	0	4	2	0	3	8	4	0	5	2	8	3	0	0	14	0	12
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Total																				

* *Family Food Plans for Good Nutrition.* Reprinted by courtesy of Bureau of Human Nutrition and Home Economics.
† Or its equivalent in cheese, evaporated milk, or dry milk.
‡ Count 1½ pounds of bread as 1 pound of flour.

recommended amounts of energy, protein, minerals, and vitamins for meals. The plans provide for three meals a day (twenty-one a week) for the whole family, including any lunch-box meals. If any of the family regularly eats one of the day's meals away from home, about one-third may be deducted from his needs for the week.

For a family planning to produce the whole amount of any one or more of the various kinds of foods needed throughout the year, multiply the quantities that the family needs for one week by fifty-two and then add something extra, from one-fourth to one-half, for guests and for a margin of safety.

How to Determine Which Plan to Follow

Whether a family will choose to follow a low-cost or a more expensive type of diet will depend upon income, the number of persons the income must support, and the importance which the family attaches to food. Those who can afford to spend more for their foods and meals than low-cost diets require probably will wish to follow the moderate-cost diet plan. The latter provides more minerals and vitamins (an extra margin of safety for good nutrition) since somewhat larger quantities of meat, eggs, fruits, and vegetables are suggested. It also allows for more flavor and variety in meals. Even greater variety can be obtained by the use of the more expensive items in the various groups.

The low-cost plan relies more heavily on the cheaper kinds of foods: potatoes, dry beans, grain products. It may also be necessary to use the cheaper varieties when a choice is given among the items within a food group. Variety at low-cost level is best obtained by trying different combinations of foods and flavors.*

How to Follow the Plan. After choosing between the two plans, write down the name of each person who eats at the family table, using the blank lines below the plan (one name to each line). Opposite each name, copy the correct food quantities for that person as indicated in the upper part of the table. When the spaces for every person have been filled in, add up each column. The totals represent the weekly food plan, giving the kinds and quantities of food for appetizing meals that insure

* *Family Food Plans for Good Nutrition*, Bureau of Human Nutrition and Home Economics.

good nutrition. Some of the foods in each group and suggestions for figuring servings are listed below.*

What's in Each Group	How to Figure Servings
Milk—Fresh, evaporated, dried, or as cheese, buttermilk, cream, or ice cream.	Use at least this much every day: for a child, 3 to 4 cups; an expectant mother, 4 cups; a nursing mother, 6 cups; other adults, about 3 cups. (A quart of fluid milk makes 4 cups.) The following can be counted the same as a quart of fluid whole milk: 17 oz. (by weight) evaporated milk. 1 qt. skim milk and 1½ oz. (3 tablespoons) butter. 5 oz. (about ⅓ lb.) American cheese.
Potatoes, sweet potatoes	Serve 11 or 12 times a week by low-cost plan; 9 or 10 times by moderate-cost plan. One pound makes 3 or 4 servings.
Dry beans and peas, nuts—including soybeans and soya products, cowpeas, lentils, peanut butter.	Serve 3 or 4 times a week by low-cost plan; 1 or 2 times by moderate-cost plan. One pound (2 cups) of dry beans or peas equals 5 to 6 cups when cooked and makes 8 to 10 servings.
Citrus fruit, tomatoes—oranges, grapefruit, tangerines, other citrus fruit, and tomatoes (fresh or canned).	Serve at least this often: a child under 4, once a day; an expectant mother, 6 or 7 times a week; a nursing mother, once or twice a day; others in the family, 4 or 5 times a week. Number of servings to the pound: Fresh oranges or grapefruit "as is" or juiced—2 to 3. Canned oranges or grapefruit in sections or as juice—about 4. Fresh tomatoes—3 to 4. Canned tomatoes, whole or as juice—about 4. There is more vitamin C in citrus fruit than in tomatoes. So, if you use all tomatoes, use half again as much as the weekly list recommends.

* *Family Food Plans for Good Nutrition,* Bureau of Human Nutrition and Home Economics.

What's in Each Group	How to Figure Servings
Green and yellow vegetables—many kinds, such as collards, kale, spinach, and other greens, cultivated and wild, carrots, peas, okra, green asparagus, broccoli, pumpkin, snap beans, yellow squash, green cabbage.	Serve 6 or 7 times a week by low-cost plan; 12 times by moderate-cost plan. Number of servings to the pound: Kale, spinach, fresh peas or Lima beans, pumpkin, yellow squash—2 to 3. Head lettuce, red or green peppers—5. Leaf lettuce, raw salad greens—8. Canned or frozen Limas, green snap beans, peas, carrots—4.
Other vegetables, fruit — beets, cauliflower, cucumbers, corn, onions, sauerkraut, turnips, apples, bananas, berries, peaches, rhubarb, dried fruits, and all the vegetables and fruits not included in other groups.	Serve 8 or 9 times a week by low-cost plan; 12 or 13 times by moderate-cost plan. One pound of fresh fruit and vegetables makes 3 to 4 servings. One pound of dried fruit makes about 10 servings.
Eggs	Serve 4 or 5 a week for each person by low-cost plan; 5 or 6 by moderate-cost plan. Use eggs more liberally if you have your own hens, or when eggs are cheap.
Lean meat, fish, poultry—all kinds, including liver, heart, and other variety meats. Count bacon and salt side in with fats.	Serve 5 or 6 times a week by low-cost plan; 7 or 8 times by moderate-cost plan. One pound of cuts with bone, such as chops, rib roasts, poultry, or whole fish, makes 2 to 3 servings. One pound of boned or boneless cuts makes about 4 servings; ground meat, 5 servings. One pound of ready-to-eat meats makes 6 or more servings.
Flour, cereals—flour or meal made from any grain (wheat, buckwheat, rye), cooked cereals, ready-to-eat cereals, rice, hominy, noodles, macaroni, breads.	Serve bread at every meal, and also a cereal food once or sometimes twice a day. Whole-grain, enriched, or restored products are best choices. One-pound loaf of bread makes 18 to 20 slices.
Fats, oils—butter, oleomargarine, salad oils, suet, shortening, lard, bacon, salt side, meat drippings.	"Spread" your fats for cooking and table use, so as to make meals appetizing and give them a stick-to-the-ribs quality. You don't need to figure exact servings.
Sugar, sirups, preserves—including any kind of sugar (beet, cane, corn, maple, and brown), molasses, or any kind of sirup or honey, jams and jellies, candy.	Quantities in the weekly plans provide for table and cooking use. You may need more for canning and preserving.

Cost of Family Food Plans. Just how much it costs to follow either of the diet plans in any community depends on the size of the family, the general level of food prices, the food choice made within the various food groups, how much food is produced at home, whether foods are bought in quantity, whether plain, rather than fancy, foods are selected, and the skill and thrift of the person who buys the food and prepares the meals.

The Bureau of Human Nutrition and Home Economics has estimated the cost of plans at September 1943 food price levels for families who must buy all their food as follows:

	Low-Cost Plan	*Moderate-Cost Plan*
Family of 2 persons	\$ 7 to \$ 8	\$10 to \$12
Family of 4 persons	12 to 13	16 to 18
Family of 7 persons	19 to 22	26 to 29

Adequate Nutrition on Racial Diets. Racial groups in the United States tend to retain their national dietary habits, which are not always adequate from the nutritional point of view. If the groups adopt any food habits of the people in this country, they are apt to choose our poorest habits, such as the liking for sweets and white breads. Improving nutrition in the United States as a whole must include educating the racial groups in the best ways to supplement nutritionally their racial diets.

In Table 30 is a list of the good points in racial dietaries and suggestions for improving them.

Adequate Diets for Overweight Persons. Physicians now believe that a condition of overweight is undesirable in adults over thirty years of age. As a result of the emphasis on weight control, many regimes, good and bad, have appeared from authentic and unauthentic sources. Since the majority of cases of overweight are due, not to glandular disturbance as is commonly believed, but to overeating, inactivity, or both, attention focuses on the diet. Much misinformation is rampant in regard to the relation of food to overweight. Too often "special" diets are so one-sided that they not only become tiresome and lacking in satiety value and thus lead to cheating (only oneself), but they are so lacking in the essential nutrients that they result in ill health and, in extreme cases, in malnutrition.

A reducing diet is no different from any other diet except in the calorie content; it should be adequate in protein and possibly more than adequate in minerals and vitamins. The rela-

TABLE 30

Supplements to Diets of Racial Groups in the United States for Better Nutrition

Nationality	*Good Points in Diet and Dietary Habits*	*Desirable Nutritional Improvement*
Italian *	Use of leafy vegetables. Fondness for fruits. Ability to make a small quantity of meat go a long way.	Use of: More milk for children. More milk in cooking and breakdown of prejudice against evaporated milk. Whole-grain bread and cereals. Cheaper American cheese and oils. More vegetables. ‡ Butter in place of other fats. ‡ Less breads and macaroni. ‡ Better vegetable cookery. ‡ Less frying of foods. ‡
Polish *	Use of: Whole-grain cereals. Many vegetables. Small amounts of sweets.	Use of: More milk, especially for children. Some vegetables raw instead of always preparing them in soups. More raw fruits, especially tomatoes and citrus fruits. Less bakery goods and sweets. Less coffee for adults and none for children. Less fried food. Better vegetable cookery.
Mexican *	Large amounts of vitamins and energy-yielding foods. May be a healthful diet.	Use of highly seasoned foods more sparingly, especially for children. Additional milk, fruits, and vegetables to fortify present somewhat deficient diets. Use of more of the foods they like.
Hungarian *	Use of rye bread. Extensive use of eggs. Small amounts of sugar used. Many fruits served as desserts. Use of many vegetables.	Use of: More raw vegetables. More cereals. More milk. Less coffee, starchy foods, and meat. More scientific preparation of vegetables to preserve their valuable minerals and vitamins.
French Canadian ‡	Use of oatmeal as a cereal. Economical and thrifty use of left-overs.	Use of: More milk for children and adults. Less sweets. Less tea. Whole-grain bread. More fruits, especially canned tomatoes and oranges when inexpensive.
Irish †	Liberal use of: Potatoes. Oatmeal and oaten bread. Fish.	Use of more: Fruit. Milk for children. Raw vegetables. Butter and cheese.

TABLE 30—*Continued*

SUPPLEMENTS TO DIETS OF RACIAL GROUPS IN THE UNITED STATES FOR BETTER NUTRITION

Nationality	*Good Points in Diet and Dietary Habits*	*Desirable Nutritional Improvement*
Jewish †	Use of: Rye bread. Legumes and coarse cereals. Dried fruits.	Use of more: Green vegetables simply cooked. Fresh fruits. Milk. Canned tomatoes. Use of less highly seasoned, fatty foods and concentrated sweets. ‡
Near Eastern † Armenian Syrian Turkish Greek	Use of: Cracked wheat and dark breads. Vegetables. Dried fruits. Care in cooking.	Use of more milk and fresh fruits. Use of less spices, oil, and fat. Giving no coffee to children.
Syrian ‡	Use of: Dark-grain cereals. Vegetables. Dried fruits.	Use of more: Milk and butter. Fresh fruits in place of sweets. Leafy vegetables. Use of less sugars, oils, fats, coffee, starches.
Portuguese †	Use of: Dark breads. Potato liquor. Fruits and vegetables.	Use of more milk, raw vegetables, and butter. Serving of 3 regular meals daily, including a good breakfast. Use of less coffee for adults and none for children.
Scandinavian †	Use of: Much dark bread. Whole grain in porridge. Much dried fruit. Fish.	Less food between meals. More milk and less coffee for children. More fresh fruits and vegetables. Less pickled foods for children.
Swedish ‡	Use of: Butter, milk, and cream. Eggs.	Use of: More fresh vegetables. More fresh fruits. Lighter meals.
Negro *	Good points of diet in South. Use of: Milk. Green leafy vegetables. "Pot likker." Eggs. Molasses. Liking for cooked cereals with milk or milk gravy.	Things to be encouraged in the North. Use of: Less meat. More milk. Whole-grain cereals, especially in breads. Less sugar. Molasses rather than changing to corn sirup Sweet potatoes as another yellow vegetable rather than as substitute for white potatoes.

* *Eating in Different Languages*, Associated Charities, 1001 Huron Road, Cleveland, Ohio.
† *Food Customs from Abroad*, C. Raymond, Massachusetts Department of Public Health.
‡ *Eating Around the World*, Community Education Section, New York State Dietetic Association. Available from American Dietetic Association, Chicago, Ill.

tion of calories eaten to body weight was discussed in Chapter II. Table 31 indicates some additional considerations in regard to overweight and also to underweight.

TABLE 31

GOOD NUTRITION FOR OVERWEIGHT AND UNDERWEIGHT PERSONS

	Overweight	*Underweight*
Meaning	Fifteen to 20% more than the weight considered normal for an individual of given sex, height, and age (See height, weight, age tables.)	Seven to 10% below the weight considered normal for an individual of given sex, height, and age (See height, weight, age tables.)
Causes	Overeating: too great a quantity of food for one's need in too many high calorie foods Lack of activity Abnormal functioning of endocrine glands (ductless glands) Note: A person may be considered malnourished even though overweight	Poor diet: Insufficient foods Wrong kind of foods Poor food habits Poor appetite Physical defects
Purpose of diet control	Reduction of number of calories eaten in food below the actual number of calories needed so the body will draw on the stored calories in the form of fat Calories needed per day: 2,500 minus 500 to 700 Calories to be eaten: 1,800 to 2,000 Note: No calories without minerals and vitamins	Increase of number of calories eaten in the foods above the actual number of calories needed so that the body will be provided with excess food calories to store as fatty tissue or reserve Calories needed per day: 2,500 plus 500 to 1,000 Calories to be eaten: 3,000 to 3,500
Characteristics of the diet	Low calorie content but optimum amounts of all other nutrients Relatively higher protein Moderate to low carbohydrates (carbohydrates never completely omitted from reducing diet) Low fats High as possible in minerals and vitamins Good satiety value	High calorie content Adequate protein of high quality Optimum amounts of minerals and vitamins Food easy to digest Appetizing foods Possibly 5 meals instead of 3 or at least in-between-meals nourishing snacks
Foods to eat	Milk, 1 pint per day; buttermilk if desired; skimmed if plenty of green and yellow foods are eaten Fresh and stewed fruits without sugar, 3 or 4 servings per day Low calorie yellow, green, and leafy vegetables; 3 to 4 servings per day (green salads used liberally) Lean meats and fish, 1 to 2 servings per day Eggs, 1 to 2 per day Whole-grain products, 1 serving per meal Cottage cheese, 1 to 2 servings per day Tea and coffee without cream and sugar Avoid: Rich sauces Gravies Rich desserts Pastries Fried foods Salad dressings Carbonated beverages Jams, jellies, marmalades Candy Note: The minimum protective diet listed at the top of page 257 with 1 pint of milk less and 1 potato and an additional serving of meat is a good guide to follow for reducing.	Milk, 1 quart per day Liberal amounts of fruits (sugar in moderation); vegetables, with butter and sauces Liberal amounts of butter, cream, cereals and breadstuffs, cream soups, nourishing high caloric desserts Moderate amounts of meat and fish Eggs, 1 or 2 per day Avoid: Too much pastries, cakes, desserts Too many fried foods Indigestible foods

QUESTIONS AND ACTIVITIES

1. List the foods you ate during the past twenty-four hours. Check this list of foods with the "Basic Seven" Chart on page 20; list the food groups which were inadequately represented and those which were adequately supplied. Study the adequate and inadequate lists of foods and indicate the nutrients which appear to be represented in adequate amounts and those which are inadequate.

2. Compute the nutritive values for the day's food record you kept in Activity 1 above. (*a*) List the foods you ate, giving the approximate amount. (*b*) Determine the food value of each of the foods from the table in the Appendix, multiplying or dividing as necessary if the amount differs from the measure or size of serving given in the Appendix. (*c*) Add figures in each column. (*d*) Compare the above figures with the daily recommended allowances for nutrients for a person of your age (Table 9, page 19). What conclusions can you draw from this study? What suggestions can you make regarding your selection of foods?

3. Keep a record of what your family buys and eats during one week and compare it with your family needs. (See Tables 28 and 29.) What conclusions can you draw from this tabulation? What suggestions can you make regarding your family's diet?

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CHAPTER XIX

GOOD NUTRITION FOR CHILDREN

Importance of Good Nutrition during Prenatal Life. Good nutrition for the baby starts long before he is born. Before birth, growth of an individual is as rapid as at any time during life, from much less than 1 gram to approximately 7 pounds at birth. This growth is possible because nutrients are furnished from the blood stream of the mother. Consequently, what the mother eats is very important for the nutrition of the baby before its birth.

Special Food Needs during Pregnancy and Lactation. Pregnancy is a period of growth, so the diet is similar to that during infancy and childhood. Growth-promoting substances are needed in abundance to meet the demands of the growing infant, but only a slight increase is necessary in the total calories. Pregnancy is a normal physiological process. It is now recognized that many disorders formerly considered usual accompaniments of pregnancy may be prevented by a diet optimal in all respects. During lactation, the production of milk for the infant makes extra nutritional demands.

The nutrients required during pregnancy and lactation are the same as those required at any other time during life, but, because of the growth demands of the fetus, larger amounts of proteins, minerals, and vitamins are required. The foods needed during pregnancy and lactation are also the same as for the adult except that larger amounts of some foods are required to cover the increased need for nutrients.

Special dietary needs during pregnancy and lactation are given in Table 9, page 19. Comparison with those of the moderately active average woman may be made.

A daily minimum protective diet for pregnancy and lactation

proposed by Dr. Wegner * includes 1 quart of milk (650 calories), 1 egg (70 calories), 1 serving of lean meat (150 calories), 3 servings of raw vegetables without sugar or oily dressing (75 calories), 3 servings of cooked vegetables without fats (150 calories), 3 servings of fruit, one-half to be uncooked, without sugar or cream (200 calories), 2 slices of whole-grain or enriched bread or 1½ ounces of whole-grain cereal (120 calories), and 1 square of butter (100 calories). This list of foods furnishing 1,515 calories provides adequate amounts of protein, minerals, and vitamins. Supplementary energy may be secured from 2 squares of butter (200 calories), 4 slices of bread (240 calories), 2 servings of potato, rice, or macaroni (200 calories), 1 serving of meat, cheese, or egg (150 calories), sugar and cooking fat (200 calories), and 1 dessert (200 calories), all of which supply an additional 1,190 calories.

Importance of Good Nutrition during Childhood. Good nutrition at any period during life depends upon not only what happens during that particular time but equally, or possibly more so, on the preceding periods through which the individual has passed. No one disputes the importance of heredity as a determining factor in one's future development. Neither can one now disregard the effect of the mother's diet before birth, the correct care and feeding of the infant, and how well nutritional demands are met during early childhood and the school age period on one's physical condition when maturity is reached. It has been said that nutrition is a continuous process. If this fact is accepted, it goes without saying that at no age can the essentials for good development and nutrition be overlooked. This is especially true during the growing period. Much of the present-day research in food and nutrition is proving very decidedly that what one eats at each period in life affects directly the next period and, in fact, the entire life span.

Characteristics of Healthy and Well-Nourished Children. "When a child is well nourished, every part of his body is receiving all the food materials that it needs to grow and function as it should. Each part of such a child's body, such as the bones, the teeth, and the blood, is constantly supplied with all that it needs of each of the dietary essentials. . . . Though all parts of

* Wegner, C. R., "Diet in Pregnancy and Lactation," *Journal of the American Dietetic Association,* **16**, 541, 1939. Courtesy, Dr. Wegner and the *Journal of the American Dietetic Association.*

the body need some of each of the dietary essentials, certain parts, as the bones, the teeth, and the blood, need relatively large amounts." *

Nutrients and Foods for Children. The essentials for good nutrition are the same at all periods of life (adequate calories, protein, minerals, and vitamins) from the prenatal period on. The amounts increase in proportion of those directly concerned with the growing process. The essential foods are the same but in different amounts: sufficient milk, fruits, vegetables, whole-grain cereals, eggs, and meats, with special emphasis on the protective foods.

In addition, quiet, peaceful surroundings, adequate rest and sleep, safe drinking water, plenty of fresh air and sunshine, play, and exercise, and protection from disease are necessary for the best development.

Recommended dietary allowances for children at different ages are given in Table 9, page 19.

Feeding the Infant. The child develops rapidly during the first few years of life. At birth, the average baby weighs 7 to 7½ pounds; it doubles its weight by the end of the fifth month, trebles it by the end of the first year, and quadruples it by the end of the second year. In length the baby grows from an average of 20 inches at birth to about 30 inches at the end of two years. At the end of twelve months he has 6 teeth, at the end of eighteen months, 12 teeth, and at the end of two years, 16 teeth. It is essential that the baby receive adequate food during this early growing period. Breast feeding is the only completely acceptable method of feeding the baby during its first few months of life. Human milk is adapted in every way to the infant's needs, and the baby that is started out in life on its mother's milk has many advantages over the artificially fed one. During the first six months the baby needs about 2½ ounces of mother's milk per pound of body weight per day, during the remainder of the nursing period, 2 ounces per pound of body weight per day.

Since there are sometimes legitimate reasons why babies cannot be breast fed, some kind of artificial feeding has to be devised. This is usually a formula of cow's milk properly modified and

* "The Road to Good Nutrition," *Children's Bureau Publication 270*, United States Department of Labor, 1942. Page 2. Courtesy of Children's Bureau.

Checking on Health and Growth *

Signs to Look for in Making the Initial Check-up of Growth and Health

1. Enjoyment of life	Exuberant spirits; zest for the job in mind.
2. Expression	Alert and happy; one of well-being.
3. Posture	Erect, suggesting power and endurance.
4. Walk	Alert, full of life.
5. Muscular coordination	Prompt and efficient.
6. Bodily repose	No undue restlessness.
7. Endurance	Individual not easily fatigued.
8. Eyes	Clear and bright, shining, showing glow of health; no puffiness or dark circles underneath; no inflammation of lining of eyelids; no definite squinting.
9. Breathing	Through the nose with the mouth closed; unobstructed.
10. Breath	Good breath; sweet.
11. Tongue	Clean, moist, and red.
12. Skin	Glow of health; smooth; not dry.
13. Color	Good color in lips and in membranes of eyelids, mouth, and tongue.
14. Hair	Smooth, lustrous, and pliable; not markedly scanty, dry, or brittle.
†15. *Teeth*	Strong and well-enameled, even, well-spaced and closing properly; clean, smooth, with no cavities, and with no permanent teeth missing; gums firm.
16. *Jaws*	Broad enough not to crowd the teeth.
17. *Shoulders*	Even, not rounded and not pushed back.
18. *Back*	Straight; curves not exaggerated.
19. *Chest*	Broad, deep, extending beyond abdomen; capable of generous expansion (2 to 3 inches, depending upon the age of the child).
20. *Abdomen*	Flat; not protruding beyond the chest.
21. *Legs and arms*	Long bones, straight; legs not bowed after infancy; joints not enlarged.
22. *Knees*	Not knocked after 4 or 5 years of age; feet and knees pointing in same direction.
23. *Ankles*	Strong, no enlargements; outer and inner sides equally prominent.
24. *Wrists*	Strong and with no enlargements.
25. *Feet*	Parallel; arches strong, not necessarily high; toes straight; joints not enlarged.
26. Muscles	Flesh firm, muscles well developed throughout the body; good muscle tone.
27. Fat	Plentiful and firm beneath the skin.
28. Weight	Suitable for height, age, and type and for build of skeleton and muscle. (A weight gain based on periodic measurements is the best index of progress of growth.)
29. Ability to relax	
30. Sleep	Sound and quiet.
31. Normal eliminations	Regular habit of elimination.
32. Colds	Infrequent.
33. Appetite	Good.

Note: The use of this list of pertinent signs of health and growth is recommended as a simple means of realizing whether or not the growth and health of a boy or girl differ unfavorably from the development he might attain. Its use is not designed to take the place of the physician's appraisal of the individual.

* *Nutrition Program. Building a Good Body.* Prepared by Hilda Faust. Agricultural Extension Service, College of Agriculture, University of California. Courtesy, Agricultural Extension Service, College of Agriculture, University of California.

† To attain completely the standards marked by italics, the growth factors must be right prenatally, in infancy, and in early childhood. The other characteristics are attainable by nearly anyone.

prepared according to a doctor's directions. Such a formula is calculated by determining how much total milk mixture the baby needs during a day, how much of the milk mixture should be milk and how much water or other diluent, and how much sugar is to be added to the formula. The total amount of milk mixture is the amount a baby can take at one feeding times the number of feedings in 24 hours. The number of feedings varies with infants, but, on the average, five feedings a day are given with the amount at each feeding being 1 to 2 ounces more than the age of the baby in months.

It has been learned that 1½ ounces of whole milk per pound of the body weight of the baby per day will supply sufficient protein, calcium, and phosphorus for the baby's needs. The total amount of milk subtracted from the total amount of milk mixture gives the amount of water which is added to the milk. Diluted cow's milk does not contain sufficient sugar to meet the baby's energy needs, so an amount in the proportion of one-tenth of an ounce per pound of the baby's weight is added to the formula. The mixture is then boiled and placed in sterilized bottles.

Neither human milk nor cow's milk is completely adequate in all the nutrients that the rapidly growing infant needs, so it is necessary to add other foods to the diet during the first year. The exact time and order in which each new food is added depend on the baby's doctor. Table 32 gives some idea about the extra foods a baby needs during the first year and the approximate time at which each is added. Periodic examination by a doctor and extreme care in the handling of food to prevent food-borne infections are likewise important during the period of infancy.

Feeding the Preschool Child. The same foods to which the baby has been accustomed during the first year are continued during the second year and the following preschool years but in greater variety, in different forms, and in larger amounts. As soon as the child has teeth, it is no longer necessary to strain or mash foods.

During the preschool period, lifetime food habits are established and it is important to see that children learn to like the foods they will need for good nutrition the remainder of their lives. Regularity of meals is especially important, and tend-

encies to eat between meals should be discouraged. The child who has never tasted candy will not ask for it; if given at all, it should be given only at the end of a meal and never between meals. More than a short-time refusal to drink milk should be studied and handled carefully so that a permanent dislike for milk will not be established. Refusal to eat new foods, craving for certain foods, poor appetite, and dawdling at meals all require patience in their treatment. Foods that children need after the first year are listed as follows by the Children's Bureau.*

Milk. One and one-half pints to a quart a day.

Fruit. Oranges, grapefruit, or raw or canned tomatoes (or their juice) every day. Other raw fruit or cooked fruit at least once a day.

Vegetables. A serving of potato and at least one or two other vegetables daily (green or yellow vegetables often).

Eggs. One egg daily or at least four or five times a week.

Lean meat, liver, fish, or poultry. Once a day or at least three or four times a week. Cheese, dried beans, or dried peas may be used occasionally in place of meat.

Dark or whole-grain cereals and bread. Two or more servings a day.

Butter, or margarine with added vitamin A. Two or three times a day.

Cod-liver oil (or other source of vitamins A and D). About 2 teaspoonfuls of cod-liver oil or its equivalent daily during the child's second year. After that age ask the doctor. (See "Substitutes for the Sun," *Children's Bureau Folder 25.*)

Additional foods to satisfy the child's appetite. Simple desserts or spreads, such as molasses or peanut butter. The type of food, as well as the amount, varies with the age and size of the child. These additional foods should not take the place of the foods already listed in the food plan.

It is especially important that preschool children develop and maintain regular and adequate sleeping habits, as the benefits of an adequate diet may be offset by an inadequate amount of rest during this period of rapid growth.

The need for adequate suppers should be mentioned in regard to the feeding of the preschool child. Too often, supper consists of the easily prepared cereal and milk. It is practically impossible for the child to secure the nutrients he requires during each day unless his supper is more adequate. It should include vegetables and fruit even for the very young child.

* "Your Children's Food and the Family Pocketbook," *United States Department of Labor, Children's Bureau Folder 24,* 1940. Courtesy, Children's Bureau.

TABLE 32

ADDITIONS TO THE INFANT'S DIET DURING THE FIRST YEAR *

Supplement	*Reason*	*Time of Addition*	*Amount*
Water		Between feedings	Winter, 2 to 3 times daily Summer, 4 to 5 times daily
Fruit juice: Fresh or canned, strained tomato; orange juice without sugar; grapefruit or lemon slightly sweetened	Vitamin C	End of 2nd week. Between any 2 feedings. Preferably in the morning.	1 teaspoon to start. Increase gradually until 2 tablespoons at 6 months or juice of 1 orange at 1 year. Use twice as much tomato juice as orange juice.
Cod-liver oil or vitamin equivalent: Standard cod-liver oil: ¼ teaspoon. 1 gram = 85 U.S.P. units of vitamin D and 850 U.S.P. units of vitamin A	Vitamins A and D in cod-liver oil Vitamin D only in most substitutes (read the label)	End of 2nd week or as soon as orange or tomato juice habit is established. Between any two feedings always at same time of day.	Few drops: increase to 1 to 2 teaspoons a day. (Amount of cod-liver oil or substitute to be determined by physician.)
Cereal, strained	Additional calories	Time varies with physician: 3 to 4 months or 4 to 6 months. Give at one of morning feedings before the bottle.	¼ to ½ teaspoon strained whole-grain cereal diluted with 1 tablespoon of milk from bottle. Increase to 1 tablespoon and give at evening feeding as well as in morning.
Egg yolk: Coddled; soft cooked; hard cooked and mashed	Iron Vitamins A and D	Varies with physician. About 4 to 6 months. Some add egg yolk to the milk mixture as early as 3 to 4 weeks, starting with a small amount and increasing to the whole egg by 4 to 5 weeks.	Very small amounts at first with a gradual increase in amount until the yolk is taken.

Zweibach, toast, or bread crust	Something to chew Small amount of energy	After a few teeth have erupted. About 6 to 9 months.	Small amounts at end of one or two meals.
Vegetables: Strained, unseasoned except for a very little salt and no fat	Additional minerals and vitamins Laxative value	5 to 6 months. At noon or 2 P.M. feeding before other foods are given.	Small amounts. Leafy vegetables at least 3 times weekly; others on other days.
Potato	Iron and vitamin C Energy	11 to 12 months	Small amounts of baked potato in addition to other vegetables.
Fruit sauces: Strained apples, apricots, prunes, peaches (cooked)	Additional minerals and vitamins Laxative value	8 to 9 months	Small amounts at 10 A.M. feeding.
Ripe banana, mashed		Strained at 4 to 6 months. Mashed later.	1 to 2 teaspoons
Desserts: Simple desserts as custard, tapioca, junket	Additional energy	8 to 9 months	Small amounts at one of feedings.
Meat: Scraped broiled beef or liver or juice of these		End of first year. Depends upon physician.	Small amounts
Butter	Energy and vitamin A	12 months	Small amounts on bread and potatoes.

* Adapted from "Feeding Babies and Mothers of Babies," H. Monsch, *Cornell Bulletin 300;* "Feeding Your Baby," *Children's Bureau Folder 20,* 1940. Courtesy, Extension Service, New York State College of Agriculture and Children's Bureau.

The Psychology of Feeding

The attitude of the child toward food and feeding is all-important. The child acquires these attitudes very early and they are persistent. It is not only important that the child shall eat the foods required for his optimum growth but it is of even more importance that he shall like them and prefer them, as only in this way will he be sure of continuing to eat them after he becomes old enough to choose his own food.

A child should never be forced to eat when he is not hungry. It is more sensible and humane to find and correct the cause. It is important to help the child establish the right feeling and attitude towards foods when they are first presented to him; also to avoid the establishment of likes and dislikes and attitudes that must be corrected later.*

The following are suggestions for establishing good food habits and breaking bad ones.† Good food habits may be established by regularity in meals, variety so the child does not tire of a few foods, balance in meals so the child does not crave certain foods, matter-of-factness about meals, family harmony as to likes and dislikes (avoidance of discussion of adult food dislikes), good cheer at table, and good meals for the family so that the child can eat the same food.

Bad food habits may be broken by changing the atmosphere, taking desirable responses for granted, giving the child time to make adjustments, not humiliating the child, ignoring all emotional explosions, not scaring the child into eating, and not telling the child fantastic tales about food, such as that carrots will make hair curl.

Feeding the School Child. The presidential proclamation on Child Health Day, the first of May 1943, especially emphasized the health of older children in the following statement: "Guard the health of boys and girls of high school age who are combining school with part-time jobs, who are working during vacation, or who are entering full-time employment." The health of this age group is always important as it is a period of rapid growth and demands enough of the right kinds of foods distributed between three good daily meals (sometimes possibly mid-meals as

* Sherbon, F. B., *The Child*, pages 476–480, 1941. Courtesy, McGraw-Hill Book Company, Inc.

† *Ibid.*

well) and plenty of sleep and rest. The same nutrients, the same foods, but in larger amounts, and still greater variety, if desired, continue through this age period. Recommended allowances for the school age are given in Table 9, page 19.

Adolescence brings increased requirements to meet the increased gains in height and weight and greater activity. No apologies need ever be offered for what appear to be ravenous appetites of adolescents. The high school boy often needs and eats more than his father.

Guard against inadequate meals, especially breakfast because of the hurry of getting off to school, inadequate lunches, eaten at home, carried from home, or chosen unwisely in the school cafeteria, and overindulgence in the candy habit. Proper health and hygiene habits are no less important for the teen-age than for the younger child. Failure of sufficient food for teen-age boys and failure on the part of girls to eat the necessary amount of food because of misconceptions about the relation of food to overweight are responsible for poor nutrition among this group. The higher incidence of tuberculosis among the teen-age girl groups than any other group indicates the importance of insuring the best nutrition at this age. In addition, these girls need plenty of iron-rich foods to meet the extra demands for iron because of menstruation.

The same meals fed the adult members of the family may be adjusted to the younger members of different ages by serving small amounts to the two-year-old, moderate-sized amounts to the six-year-old, and very generous servings to the ten-year-old.

A food score card for boys and girls is shown in Table 33.

The School Lunch as a Health Factor in Child Nutrition. Regardless of the place where the noon meal is eaten, it is an important feature in the health and nutrition of the school child. Food is thought to be better handled by the body when divided into three meals; the noon meal should, therefore, provide approximately one-third of the child's food requirements of the day. Just as an adequate breakfast prevents overfatigue during the morning, so does an adequate lunch prevent mid-afternoon fatigue.

Many school children are unable to go home for the noon meal. They are confronted with the problem of what to carry from home as a complete lunch, how to supplement the lunch

they carry with the food furnished by the school, or how to choose a satisfactory lunch in the school lunchroom or cafeteria. In any case a good lunch is essential, a lunch that contains milk,

TABLE 33

FOOD SCORE CARD FOR BOYS AND GIRLS *

HOW WELL DID YOU CHOOSE YOUR FOOD TODAY?

What you ate	How much and what kind		Your grade today	Your grade 2d week	Your grade 3d week	Your grade 4th week
	1 cup of milk 2d cup of milk 3d cup of milk, or more	Points 10 10 10				
	Potatoes or sweet potatoes Tomatoes, or orange, or grapefruit A green or yellow vegetable Another vegetable or fruit One of your vegetables or fruits raw	10 10 10 5 5				
	One or more helpings of eggs, or meat, or poultry (or dried beans or peas)	15				
	Whole-grain cereal At least 2 slices of whole-wheat or enriched bread	5 10				
	Did you skip breakfast?	Subtract 10				
	Did you eat sweets before meals? For each time	Subtract 10				
	Your eating grade	Perfect is 100				

* "Food for Growth, Food for Freedom," Courtesy, Bureau of Human Nutrition and Home Economics, United States Department of Agriculture.

fruit, vegetable, or both, a whole-grain breadstuff, a hot dish during the winter, and a dessert, if desired.

No lunch is complete without milk in some form. Better nutritive returns for the money are received from a bottle of

regular milk than from a bottle of commercial chocolate drink. When whole-grain or enriched breadstuff and fruit are added, an excellent lunch is obtained. The whole-grain and enriched breadstuffs provide additional minerals and vitamins as well as energy. The fruit makes the meal more palatable and furnishes minerals and vitamins. This lunch becomes more satisfying if a hot dish is added.

A simple dessert, such as plain cake, cookies, gingerbread, or milk pudding, may be added to the school lunch if desired, although it is unnecessary; it is better than candy as it supplies body-building materials as well as energy. Fruit makes an excellent dessert to top off the school lunch. Soda, tea, and coffee are not good in the school lunch as they have no food value, and their cost in proportion to the nutritive value received is much greater than that of milk. In addition, tea and coffee, because of their stimulating properties, may not be too desirable for the school child. Measuring sticks for good school lunches to be eaten in the school cafeteria or carried from home are shown in Tables 34 and 35.

Nutrition and the Teeth. Because of the nature of the teeth, they are often thought of as structures apart from the rest of the body. They are, however, part of the body structure, just as the muscles are, and are similarly affected by the food. Their original formation in the jaw, their eruption, and what happens to them after they erupt are now known to be dependent upon what is brought to them in the way of nutrients from the food which is eaten.

Of the two sets of teeth which every individual produces, the first set (twenty of them) are already in the jaw before birth. For this reason, what the mother eats and what her food furnishes in the way of tooth-building substances are extremely important. These first teeth are called temporary or deciduous teeth. The first erupts at about six to seven months, three more by the end of the first year, another twelve to fourteen during the second year, and the remainder by two and one-half years.

While the temporary teeth are getting ready to erupt and finally do so, the permanent teeth, which are also in the jaws before birth, are being prepared to take the place of the first teeth, the last one of which is lost and replaced at about twelve years.

From one to six years on they are being calcified in the jaws below the decidous teeth and the jaw is developing to accommodate their eruption. By six years, one of the four so-called six-year molars erupts. The permanent set of thirty-two teeth is completely erupted at about the fifteenth year.

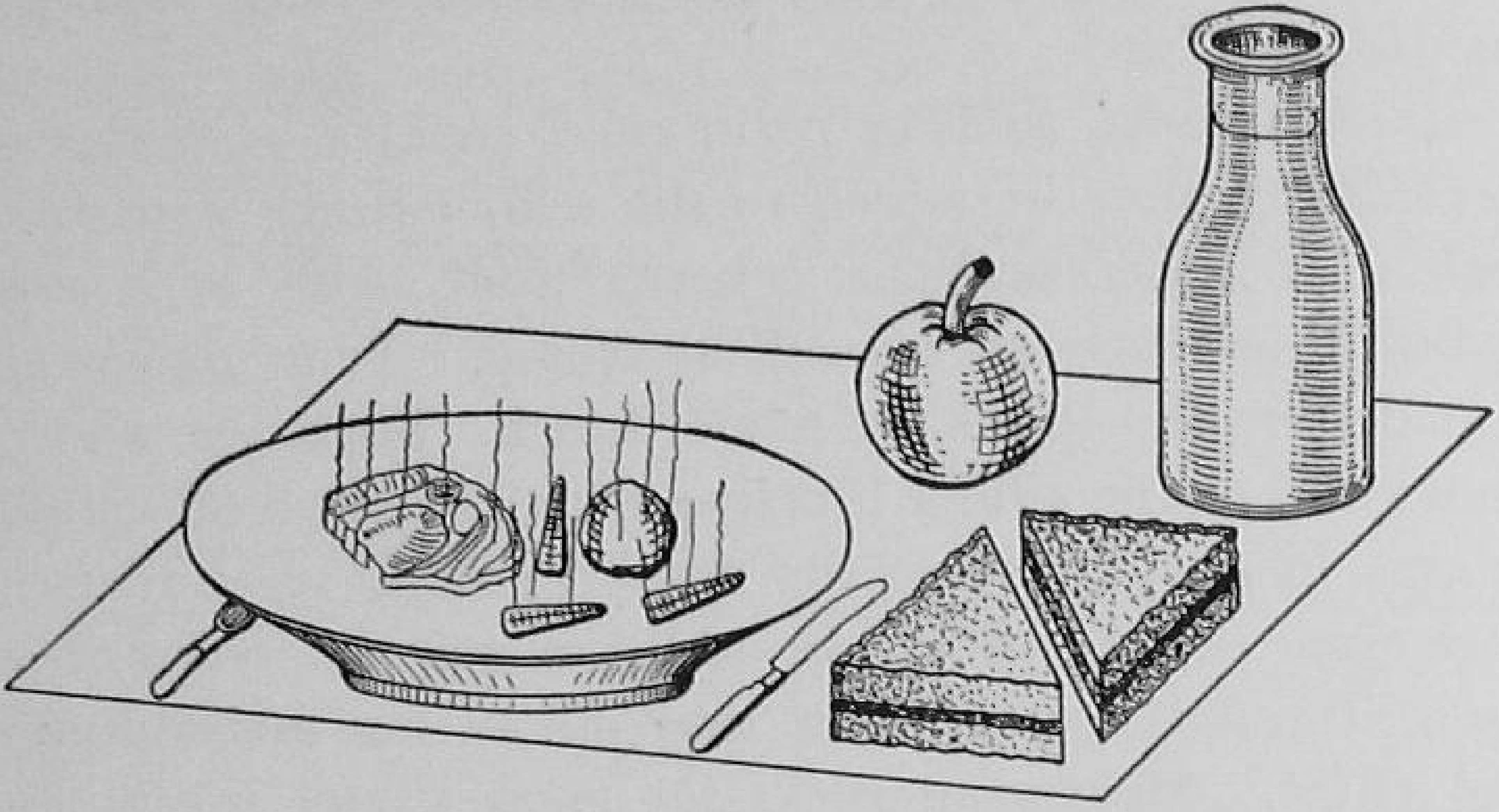
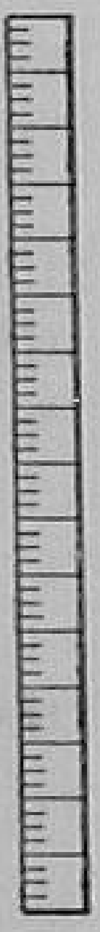


TABLE 34

A MEASURING STICK FOR A WELL-CHOSEN LUNCH *

(*School Cafeteria*)



Milk. One-half pint whole milk.
A hearty food. Meat, fish, poultry, eggs, cheese, or beans in main dish or in sandwich.
Fruit, vegetable, or both.
Fresh, as apple or orange.
Cooked, as string beans or apple sauce.
A full serving, as ½ cup cole slaw.
Bread, whole-grain or enriched.
Well spread with butter.
Sliced, or as a sandwich.
Add. Potato, rice, dessert, or extra servings of above.
Time. Thirty minutes, or at least 20 minutes, for a pleasant lunch.

Tips

A hot dish is desirable in cold weather.
Raw vegetables, like crisp carrot or turnip sticks, celery, or ripe tomatoes, add good value and zest.
Whole-grain muffins offer a tasty variation.
Fruit for dessert tastes good.
Puddings made with milk and eggs are good buys.
Older children need larger servings or two servings of foods.

* Courtesy, Massachusetts Department of Public Health.

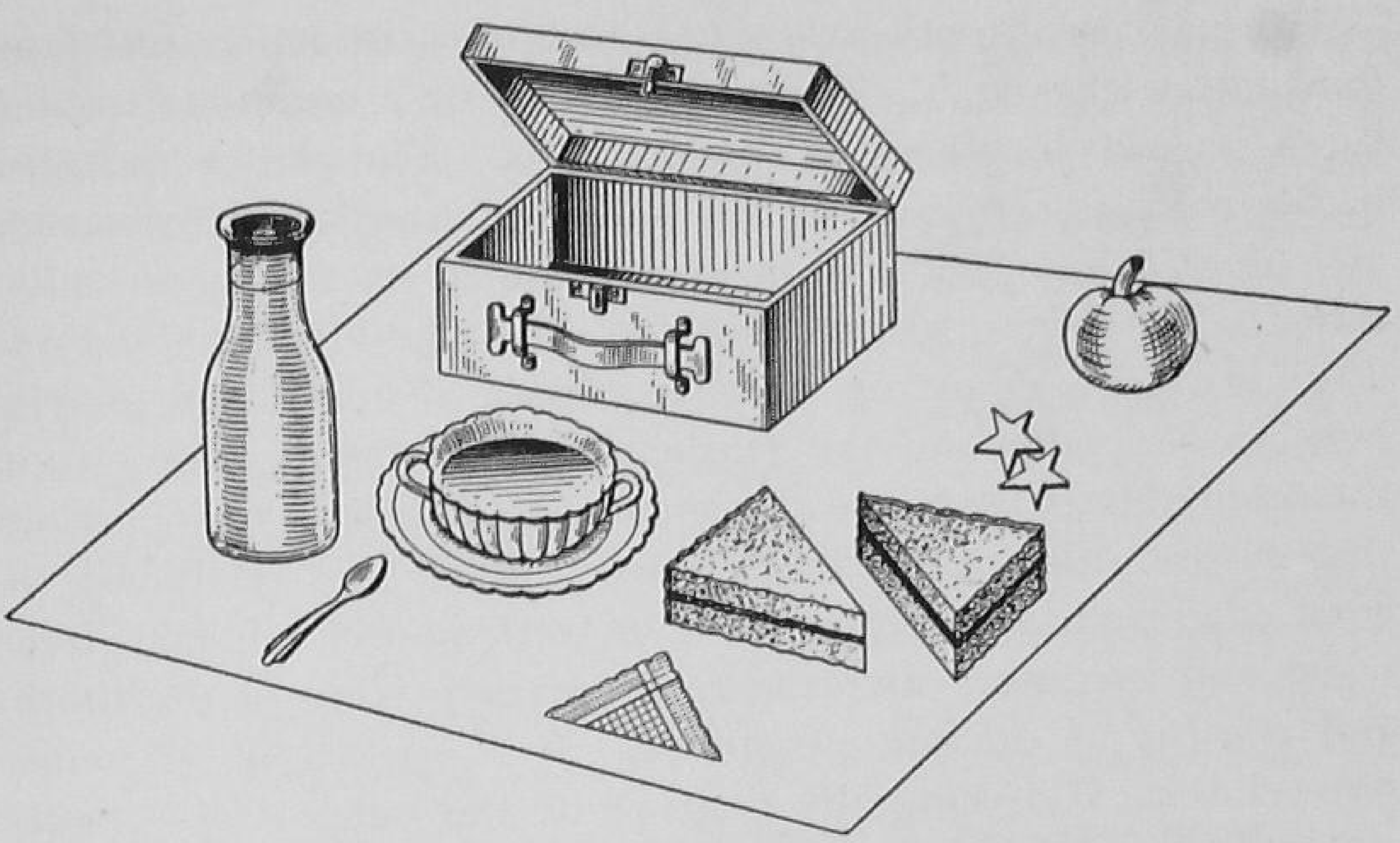
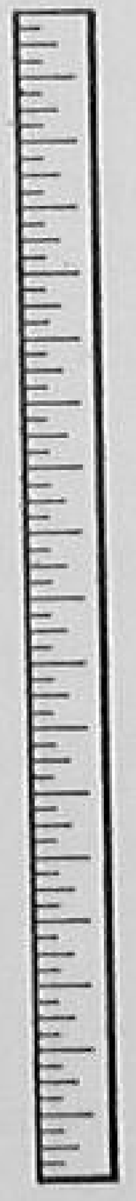


TABLE 35

A Measuring Stick for a Good School Lunch *

(Brought from Home)



Milk. One-half pint whole milk in jar or thermos.

A hearty food.

Meat, fish, poultry, eggs, cheese, or beans in sandwiches or carried in a small covered jar or wrapped separately, as hard-cooked eggs.

Sandwiches give variety if they include a hearty—meat, fish, egg, cheese; a crisp—lettuce, cabbage, raw carrot, or apple; and a sweet filling—date or pineapple and cream cheese.

Raw fruit or vegetable fillings are especially good.

Fruit, vegetable, or both.

Fresh, as apple or orange; ½ cup cole slaw.

Cooked, as apple sauce. May be carried in a tightly covered jar.

Bread, whole-grain or enriched. Well spread with butter.

Add. One or more servings of bread, cheese, dessert, or other such food.

Time. Thirty minutes, or at least 20 minutes, for a pleasant lunch.

Tips

A hot dish is desirable in cold weather.

Raw vegetables, like crisp carrot or turnip sticks, celery, or ripe tomatoes, add good value and zest.

Whole-grain fruit or nut muffins make good variations.

Fruit, custard, gingerbread, and oatmeal cookies are excellent desserts.

Older children need larger servings or two servings of food.

* Courtesy, Massachusetts Department of Public Health.

To understand tooth structure is to appreciate better just how food affects the teeth. What appears to be a completely solid tooth is really made up of several parts. The central portion of the tooth is composed of soft pulpy cells supplied by nerves and blood vessels. The pulp is surrounded by a layer of cells, called odontoblasts, which form the dentine. During the time when growth is occurring, there is a space of uncalcified matrix between the pulp and the harder dentine. Small fibers from the odontoblasts lead into this matrix, and it is in this portion that future calcification takes place. When the teeth are in good condition, this area is thin; in teeth poorly calcified, it is wider and irregular. Dentine is the main portion of the tooth and consists of calcium phosphate. It is spoken of as being non-cellular. Covering the dentine of the part of the tooth exposed above the gum is the enamel, a hard, smooth, brittle substance, also non-cellular. However, if observed under the proper conditions, enamel would look like prisms. The blood vessels in the pulp bring nourishment to the tooth structure just as they carry it to other parts of the body.

If a tooth is poorly developed structurally, it is spoken of as a hypoplastic condition or hypoplasia. This is not the same as dental decay or caries, which is actual decay and disintegration of the tooth. However, it is thought by some that a poorly developed structure in the tooth predisposes to dental caries.

It should be reasonable to assume that a diet which provides all nutrients essential for good health and nutrition will provide also good teeth, or that improvement of general health will improve dental health. This has been proved to be true but there seem to be additional special considerations as well. To produce and maintain teeth, materials must be brought to them through the blood supply from the food eaten after its absorption in the digestive tract. The nutrients which seem to be of especial significance in this connection are the minerals calcium and phosphorus and vitamins A, C, and D. Each appears to have a different but equally important function in tooth health.

That the teeth may be affected by food in other than nutritional ways has also been proved to the satisfaction of some workers. The excessive consumption of sugar as such or in candy has long been thought to have a direct detrimental effect on the teeth. Its effect is now explained in the following ways: sugar,

which supplies calories only, satisfies the appetite quickly and removes the desire for the more bland foods, which are rich in minerals and vitamins, and therefore crowds these tooth-building substances out of the diet. It is also thought that sugar encour-

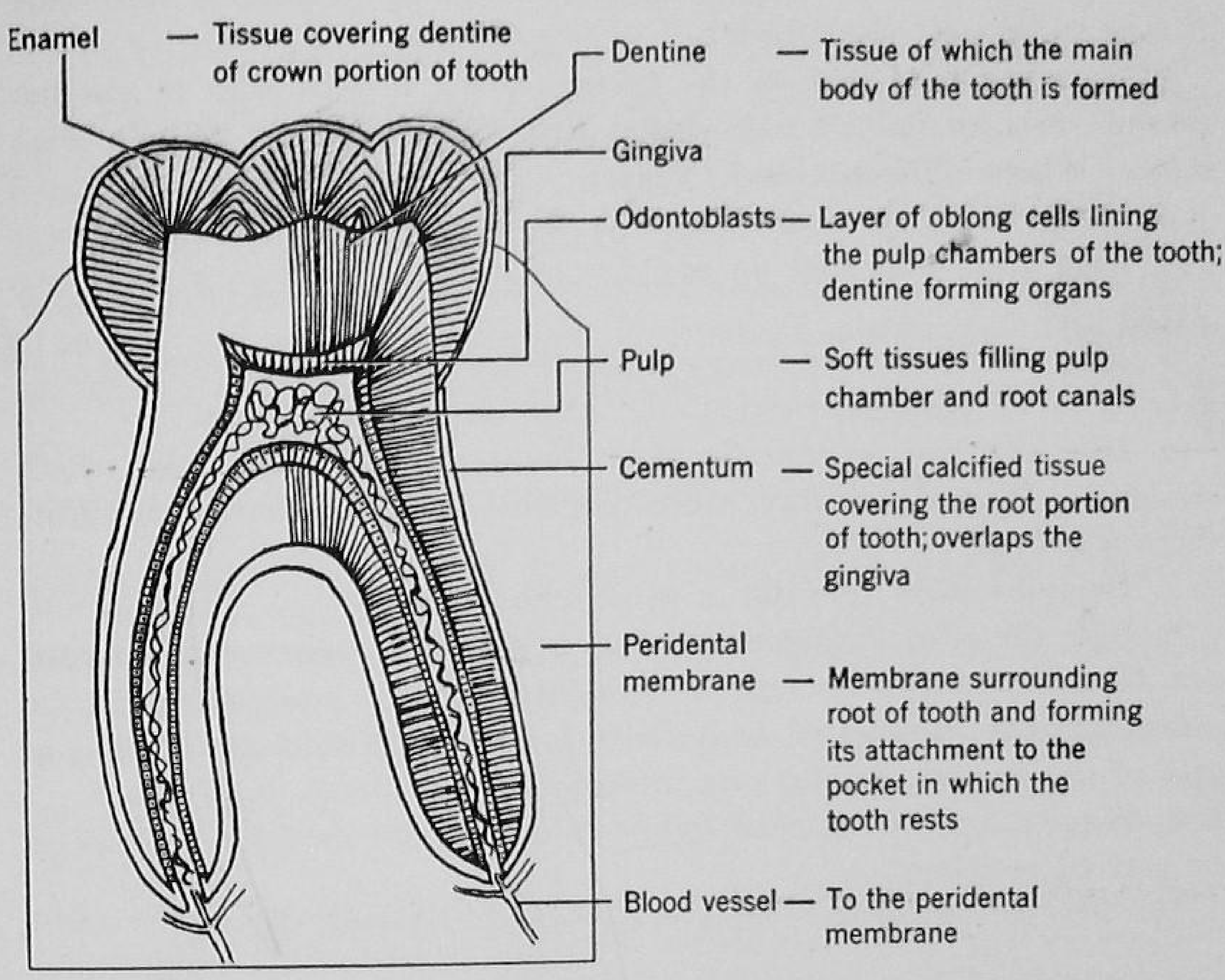


FIG. 35. Structure of a tooth (diagrammatic sketch). Adapted from G. V. Black, *Operative Dentistry*, Vol. 4, 7th Edition. Courtesy, Medico-Dental Publishing Company.

ages in the mouth a type of bacteria not considered desirable for tooth health.

Heredity cannot be overlooked as a factor in tooth health since "good teeth" and "poor teeth" seem to run in certain families where hygienic and dietary habits would not seem to be causes.

Regardless of what specific factor any one dental nutritionist thinks is the chief one in dental health (and there is still much disagreement in this connection), there seems to be perfect agreement by all on two points: the more protective foods in the dietary and the less sugar, the better the dental health.

Tooth structure is shown in Figure 35.

QUESTIONS AND ACTIVITIES

1. Suggest ways to include milk in the foods for a preschool child who does not like to drink too much milk.

2. How much breast milk will a baby weighing 10 pounds need daily if it is to be well nourished?

3. How much of each of the following will a baby who weighs ten pounds, is three months old, and is artificially fed need? Whole cow's milk? Whole milk mixture? Sugar?

4. Using the Food Score Card for Boys and Girls, Table 33, page 266, score your daily diet on one day of each week for four successive weeks.

5. Why should every person eat an adequate breakfast? Why should a high school student, particularly, have an adequate breakfast?

6. How can you account for poor dietary habits among high school students? Why should high school students have the very best possible dietary habits?

7. Devise a score card for a good school lunch.

8. Visit the school cafeteria during serving time, observe and record ten to twenty lunches eaten by students, and score according to the score card you formulated in Activity 7, above. (Could the lunches of any of the faculty members be improved?)

9. Suggest combinations of foods which may be used for lunches to be carried to school.

10. The following are two average school cafeteria menus.

MENU 1

Noodle soup
Lamb stew
Italian spaghetti
Buttered green beans
Buttered red cabbage
Tuna fish and olive sandwich on whole-wheat bread
Chopped date and nut sandwich
Whole-wheat and white bread
Lettuce salad and Russian dressing
Waldorf salad
Gingerbread and whipped cream
Fruit cup
Baked custard
Cocoa, milk

MENU 2

Cream of tomato soup
Meat loaf—gravy
Baked potatoes
Baked Lima beans and bacon
Buttered beets
Chopped spinach
Egg and lettuce sandwich on whole-wheat bread
Cream cheese and currant jelly sandwich
Whole-wheat and white bread
Chocolate layer cake
Baked apple
Lemon meringue pudding
Cocoa, milk

a. Select a luncheon from each which will satisfactorily supplement the breakfast and dinner menus which you have at home for two days.

(Keep a record of breakfast and dinner at home for two consecutive days.)

b. Select a menu from each for a faculty member who wishes to make this meal the main meal of the day.

c. Select a lunch from each with two dishes only, one a hearty one and one a milk dish.

d. Select a light meal, a medium meal, and a heavy meal.

e. What foods are good energy foods? Good sources of minerals? Of vitamins?

11. Keep a record of the lunches eaten in the school cafeteria or brought from home for a week. Calculate the nutritive value of several of these. Do they meet one-third of the recommended daily allowances for specific nutrients for one of your age?

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CHAPTER XX

MEAL PLANNING

Importance of Good Meal Planning. Throughout previous chapters the importance of an adequate and well-balanced diet as a requirement for good nutrition, health, and happiness has been repeatedly stressed. Whether or not an individual receives and eats the essential foods depends upon many factors, important among which is the combination of these foods into attractive and enjoyable meals that are well prepared and well served.

Approximately one thousand meals are prepared and served by the homemaker in the course of a year, with approximately one-fifth of the family income being spent for food. These facts alone point to the great responsibility involved, but when, in addition, it is realized that these meals determine the well-being of her family, the responsibility becomes even greater. To the individual, these thousand meals provide some of the greatest pleasure and most enjoyable associations of life. Consequently, meal planning, as done by the homemaker for her family or by the individual who finds it necessary to eat in some place other than the family circle, becomes an important practical problem in nutrition.

What Meal Planning Involves. From the standpoint of nutrition, the planning of meals resolves itself into something more complicated than the mere satisfying of hunger. The housewife must take into consideration the age and growth needs of the children and the amount of exercise taken by each member of the family in order to be able to judge adequately the kind and amount of food required by each. The man at active muscular work will use up more calories than the man of sedentary habits and will be able to digest, with ease, heartier foods. The diet of children requires that special attention be paid to a supply of growth-promoting foods.

Since the whole day (three meals), and not one meal, should be the unit for meal planning, the official food chart on page

20 indicates the foods which need to be planned for in the daily diet. It provides an excellent starting point in planning meals and relieves the necessity of thinking of food requirements in terms of calories, grams, units, etc.

Food costs need some consideration in menu planning. First, decide how much of the monthly income should be appropriated for food, and the approximate daily and meal expenditure. As much as 50 to 60 per cent of low incomes may have to be spent for food; this proportion decreases as the income rises.

Types of Meal Plans. The meals of the day include, for most people, breakfast, luncheon at noon, and dinner at night. For some, dinner is served at noon and a supper at night.

The type of meals to be served, whether light, medium, or heavy, depends upon the food needs of the individual and of the family as a whole. The breakfast of the average family is probably light to medium except where the various members are engaged in unusually strenuous activity. The type of luncheon or supper will depend somewhat on the general nature of the other meals as well as upon the activities of the individuals. If it is a luncheon, the type of breakfast may be a determining factor. The person of sedentary occupation will do better to have a light luncheon, whereas the active person will need a somewhat heavier meal. Dinner is usually the meal at which meat is served, and the heaviness of the meal is determined both by the type of foods served and the number of courses.

Breakfast, which is the simplest and most informal meal of the day, may consist of a choice of the following foods: fruit, fresh or stewed; cereal, preferably whole-grain, served with milk or cream; a breadstuff, as bread, toast, rolls, muffins, popovers, griddlecakes, waffles; a hot dish of eggs, sausage, etc.; a hot beverage, as tea, coffee, cocoa, or postum. A light breakfast will omit the cereal and hot dish, a moderate breakfast will omit the hot dish, and a heavy breakfast may include a food from each of the above groups and possibly a second hot dish. Breakfasts probably vary less from family to family than any other meal.

Luncheon or *supper* usually has the same number of courses as dinner, but it is made up of lighter foods. An informal luncheon may consist of one or two courses only and still offer the needed variety. A simple luncheon includes soup, salad, and breadstuff; it may be made into a moderate one by adding a

dessert or substituting a hot dish for the soup; it may be made more elaborate by adding a hot dish and dessert and possibly an appetizer.

Dinner, which is the heaviest meal of the day, may be served either at noon or night. It is probably best for most adults when taken at night, which permits a more leisurely procedure and is not then followed by active work. For children, the heaviest meal of the day should be served at noon. A simple or light dinner has a meat course, a salad or soup, dessert, and beverage. An elaboration of these foundation courses may constitute a moderate meal; a further addition of appetizer and entrée will make a still heavier meal and be the basis for a formal menu. Soup and salad are not considered necessary at the same meal, and one or the other may be eliminated. The chief value of the clear soup at dinner is to stimulate the flow of the gastric juice and prepare the stomach for the remainder of the meal. The salad course offers an opportunity to introduce a succulent fruit or vegetable into the meal. The use of a salad for a first course is a pleasing innovation. Appropriate salads may also be used in place of a dessert course in informal meals as well as the main course in lighter meals.

The following generalizations apply to a discussion on the types of meals. With the number of courses increased in the meal, each course becomes correspondingly lighter. It is a good thing to serve at least one hot dish in a meal. Creamed soups or rich salads or rich desserts go better with light meals, while clear soups and lighter salads and desserts are better accompaniments to heavier meals. Luncheon dishes containing meat may be prepared from leftover meats. The food value of any meal should be kept essentially the same, day after day. Some food from each of the food groups should appear at each meal, if possible. Larger portions of fewer foods may be substituted for smaller portions of a larger number of foods.

What Is a Good Menu? To plan each meal so as to supply a definitely prescribed amount of each foodstuff is an impossible and unnecessary task for the average person and diet. Each meal should furnish approximately one-third of the daily food requirement although, in actual practice, the breakfast provides about one-fourth, with the remaining three-fourths distributed between the other two meals. The one-time much-overworked

term "balanced meals" has therefore lost its implied meaning of furnishing an exact amount of each of the foodstuffs at each and every meal. In its newer and broader sense, the term signifies the provision at each meal of a well-selected variety of foods which will represent the various foodstuffs and furnish a part of the day's requirement for each. In the course of a day, such carefully selected meals will offer a sufficient amount of all kinds of the foodstuffs and will thus provide for the daily needs of the body. They will also insure the presence in the diet of sufficient amounts of the so-called "protective foods," milk and its products, vegetables, fruits, and eggs (protective in that they enrich the diet in calcium, iron, and vitamins A, B, C, and G).

In addition, the foods in the meal should be suitable for the season, have good satiety value, be attractive to the eye and taste because of variety in foods and combinations, methods of preparation, and pleasing contrast in color, form, texture, and flavor, and should give good value for the money expended. The final requirement for a menu is that it shall contain quantities of vitamin Z, a make-believe vitamin to put zest and enjoyment into the meal.

Variety in Food. It is possible to meet nutritional needs with no variety in the foods served, but the old saying "variety is the spice of life" holds good in menu construction. Variety in the combination of foods, methods of preparation, and serving does much to tempt the appetite and relieve the monotony of the ordinary diet. Great variety is not absolutely necessary from day to day, but serving the same food in the same way time after time is the surest way of making it a drug on the appetite. Interest in meals may be obtained in many ways: by varying the foods and food combinations themselves; by paying attention to the different methods of preparation; by combining different flavors, colors, textures, and forms of food, and by the use of garnishes.

Food Combinations. Certain long-established food customs may determine some of our common food combinations of today, and perhaps there is some good basic physiologic explanation for some of them. There is no reason, however, why we cannot become somewhat adventurous occasionally and break away from these habits and possibly even invent new ones. The continued companionship of lamb, mint jelly, and peas certainly

is no reason why lamb should be any less relished when accompanied by crab apple or currant jelly and string beans or asparagus. The proverbial ham or cold cuts and potato salad might well part company occasionally and each take up with new companions. Ham or cold cuts with rice croquettes or rice with mushroom sauce and a vegetable salad might be only one of a number of welcome changes. Occasionally substituting white or brown rice or a cornmeal dish for potatoes on a menu is interesting. True enough, cereals are acid-forming whereas potatoes are base-forming (a point on which this substitution is often criticized), but no harm will result from the occasional use of these products in the way suggested. Parsley and pimiento have always done their bit to help dress up an otherwise colorless dish, but watercress, mint leaves, lemon slices with edges dipped in paprika, etc., are equally good substitutes. It is well to combine simple dishes that are easier to digest with the richer ones that are harder to digest; the more concentrated ones with less concentrated ones.

Methods of Preparation. By studying the different methods of preparation for a single food, it is possible to obtain interest and variety in meals. Then, too, a new method of preparation may encourage one to learn to like a hitherto disliked food. In one cookbook alone are found forty-five different ways of cooking and serving eggs and about an equal number of ways of serving cheese, beef, potatoes, apples, and other foods.

Ingenuity in the use of leftovers and the stretching of some of the more expensive foods afford infinite means of obtaining variety. The Sunday roast need not appear on successive days as roast. New ways may be devised for using smaller amounts of leftovers instead of reheating and serving them in their original form. Though cream sauce may change and add interest to many foods, it is not well to have more than one creamed dish on a menu. Certain foods may sometimes be served raw to make for variety.

Flavors in Foods. The combination of contrasting flavors in a menu is another way of bringing variety and interest to the meal. Bland foods are usually served with stronger-flavored ones; an insipid food, with a piquant sauce. Two strong-flavored vegetables, as onions and broccoli, two gas-forming vegetables, as beans and cabbage, or two vegetables of the same family, as Brussels sprouts and cauliflower, in the same meal or vegetable

plate are undesirable. A food with distinctive flavor, as tomatoes or chocolate, repeated in the same meal does not show good planning.

Color. The natural colors in foods, particularly in fruits and vegetables, are so abundant that a colorless meal need never be served. Pleasing combinations of colors are, of course, essential. How much more interesting in color is a plate containing sliced tongue, steamed brown rice, and a green vegetable salad than one of sliced chicken, scalloped potatoes and waldorf salad; or a plate of stuffed baked potato, glazed carrots, buttered peas, and cauliflower au gratin as compared with one of candied sweet potato, creamed carrots, mashed turnips, buttered beets. With some attention given to the natural color of foods when planning meals, one need not resort to artificial colors to make them interesting.

Texture (Consistency). Equally important for the palatability of meals is attention to the texture or consistency of the foods that are combined. Soft foods should be combined with those more crisp in character. It is even well to have the courses in a meal contrast in texture. A meal of scalloped salmon, potato puff, chopped spinach mold, rolls, and lemon pudding is of too soft a consistency throughout and can be improved by changing the potato puff to French fried potatoes, the spinach mold to string beans, adding a lettuce salad, and substituting baked apple for dessert. A crisp salad is a valuable addition to any meal inclined to softness.

Form. Interest in meals may be obtained by considering the form in which the food appears. A croquette, parsley potato, stuffed baked tomato, clover leaf roll, molded fruit salad, and chocolate blanc mange are too similar in shape to make an attractive combination in spite of the variety in color, texture, and flavor. Improvement in the form of this meal could be made by changing the potato to creamed potatoes, the stuffed tomato to broiled tomato slices, and the molded salad to an ordinary fruit salad.

Score Card for Meal Planning. The score card in Table 36 may be used for checking desirable nutritional and esthetic features in a menu.

Three Meals a Day from the Official Food Chart. The "Basic 7" foods for good nutrition (the official food chart)

provide a good starting point for menu planning. Skeleton menus may be made up from this list of foods to serve as guides in selecting foods for the three meals of the day. Such suggested plans or skeleton menus are shown in Table 37. Skeleton menus for overweight and underweight are given in Table 38.

With these skeleton outlines to follow, the next consideration is the choice of the foods within each meal so that it

TABLE 36

SCORE CARD FOR MENU PLANNING

Nutritional Requirements		75
Are all principles of nutrition represented?		
Energy: is it adequate for the type of meal?	15	
Protein: is it suitable in kind and amount?	10	
Minerals: are calcium, phosphorus, and iron represented?	10	
Vitamins: are vitamins A, B_1, G, and C present?	10	
Are the protective foods well represented?	10	
Is the choice of food good for bulk?	10	
Is the choice of food good for digestion?	10	
Esthetic Requirements		25
Is there variety in foods and preparation?	5	
Is there pleasing contrast in flavor?	5	
Is there pleasing contrast in color?	5	
Is there a contrast in consistency?	5	
Is there a contrast in form?	5	
Total points		100

will be esthetically satisfactory. It is not difficult to see that a perfectly planned meal, as far as the principles of nutrition are concerned, might be a most unattractive and unpalatable one. Appearance and the service of a dish are greater factors in its proper enjoyment and digestion than is often realized.

Sample Meals. The menus shown on page 283 have been planned to illustrate the different points in the preceding discussion.

Menus for One Day to Meet Recommended Allowances. In Table 39 is shown a day's menus. They meet the standards of the official food chart for foods and the recommended daily allowances suggested by the National Research Council for specific nutrients for a moderately active woman.

TABLE 37

PLANS FOR USING DAILY FOOD GUIDE

Plan 1	Plan 2	Plan 3
	Breakfast	
Vitamin C fruit [2] * Whole-grain cereal [6] with milk [4] Enriched toast [6] and butter or oleomargarine [7] Milk or cocoa for children Coffee for adults	Fruit [3] Egg [5] Whole-wheat bread [6] and butter and oleomargarine [7] Milk [4] Coffee	Dried fruit [3] Whole-grain waffles or griddlecake or cereal [6] Milk [4] Coffee
	Lunch or Supper	
Milk soup or Egg dish [5] Salad from [3] Enriched bread [6] and butter and oleomargarine [7] Fruit [3] or fruit dessert Milk	Fruit juice [2] Vegetable plate: Potato [3] Vegetable [1] Vegetable [3] Whole-grain bread [6] and butter or olemargarine [7] Milk dessert Milk	Dried bean or pea soup [5] or Main dish [5] Green vegetable [1] Fruit salad [2] and [3] Enriched bread and butter or olemargarine Fruit salad for dessert
	Dinner	
Meat or meat substitute [5] White potato [3] Vegetable [1] Vegetable [3] or vegetable salad [2] Whole-wheat bread and butter or oleomargarine Simple dessert Milk for children Tea or coffee for adults	Meat or meat substitute [5] Whole-grain rice [6] Vegetable salad [2] or [2 and 3] Enriched bread and butter or oleomargarine Fruit cup [2] and [3] Simple cookies made with whole grain Milk for children Tea or coffee for adults	Citrus fruit juice [2] Egg dish 2 vegetables [1] and [3] or Vegetable [3] and salad [2] Whole-grain breadstuff Simple dessert Milk for children Tea or coffee for adults

* Numbers in brackets refer to food groups in Figure 6.

TABLE 38

Skeleton Menus for Overweight and Underweight

	Overweight	Underweight
Breakfast	1 serving fruit 1 serving whole-grain cereal with milk (no sugar) or 2 thin slices of whole-grain or enriched toast lightly buttered Coffee, top milk from pint for day	1 serving fruit 1 serving whole-grain cereal with cream and sugar 1 egg 2 slices whole-grain or enriched toast with butter and marmalade Coffee with cream and sugar, or cocoa
Mid-morning		1 glass of milk or milk and cream
Noon	Clear soup (if desired) Egg or small serving of meat or fish or cottage cheese Large serving of green salad or 2 low-calorie vegetables 1 slice whole-grain or enriched bread lightly buttered or 1 small whole-grain or enriched roll or muffin lightly buttered 1 serving fruit without sugar or 1 small serving of simple dessert Glass of milk Tea with lemon	Creamed dish on toast or scalloped dish Fruit or vegetable salad with mayonnaise 1 slice whole grain or enriched bread with butter Fruit or other nutritious dessert Milk
Mid-afternoon	Tea with lemon or 1 cup bouillon or raw celery or carrot strips	Milk shake or malted milk or crackers and cheese with milk
Night	Tomato or unsweetened fruit juice 1 large serving lean meat, fish, or poultry 2 servings low-calorie vegetables or 1 small potato and 1 serving low-calorie vegetable Green salad with vinegar or lemon juice or small fruit or vegetable salad without dressing 1 serving fruit without sugar or small portion of simple dessert (if no dessert at noon) Coffee or tea without cream and sugar	Cream soup Serving of meat, fish, or poultry Potato and butter 2 servings of vegetables with butter Fruit or vegetable or green salad with mayonnaise Rolls or bread (whole-grain or enriched) and butter High-calorie easily digested dessert
Evening		1 glass of milk

MENU 1	MENU 2	MENU 3
	Breakfast	
Stewed prunes Oatmeal, milk or cream Muffins, butter, jam Coffee (adults) Milk (children)	Cream of wheat with dates or raisins Scrambled eggs Toast, butter Coffee (adults) Milk (children)	Orange or grapefruit juice Shredded wheat, milk or cream Toast, butter and marmalade Coffee (adults) Milk (children)
	Luncheon or Supper	
Jelly omelette Mixed vegetable salad Whole-wheat bread and butter Baked apple Milk to drink	Split-pea soup Fruit salad Rye bread and butter Gingerbread with whipped cream or sauce Milk to drink	Baked noodles and tomatoes Buttered spinach Lettuce salad Bread and butter Caramel custard Milk to drink
	Dinner	
Tomato bouillon Meat loaf with scalloped potatoes or Ham loaf with southern spoon bread Buttered string beans Bread and butter Chocolate or maple nut pudding	Baked fish or scalloped salmon Stuffed baked potatoes Buttered beets Cole slaw Bread or rolls, butter Lemon meringue pie	Shepherd's pie with lamb or beef, vegetables and potato crust Bread or rolls, butter Fruit or fruit salad for dessert Oatmeal cookies

COMBINATIONS FOR VEGETABLE PLATES

1

Stuffed baked potato
Broccoli, mock Hollandaise sauce
Buttered carrot slices
Buttered peas

2

Buttered Limâ beans
Cauliflower au gratin
Buttered spinach
Harvard beets

3

Hubbard squash
Buttered peas
Creamed celery
Spinach mold

4

Corn pudding
Fried eggplant slices
Broiled tomato
Buttered asparagus

5

Rice croquettes, tomato sauce
Buttered string beans
White turnip cubes, buttered
Buttered beet slices

6

Candied sweet potato
Buttered asparagus
Creamed onions
Scalloped eggplant

TABLE 39

An Adequate Diet for a Moderately Active Woman

Foods	*Measurements*	*Weight, gm.*	*Calories*	*Protein, gm.*	*Calcium, gm.*	*Iron, mg.*	*Vitamin A, I.U.*	*Thiamin, mg.*	*Riboflavin, mg.*	*Ascorbic Acid, mg.*
				Breakfast						
Grapefruit	½ small	100	43	0.50	0.02	0.30		0.040	0.060	43
Rolled oats	¾ cup	100	99	4.05	0.015	0.75		0.015	0.042	
Enriched toast	2 slices	60	152	5.80	0.070	1.36		0.192	0.152	
Fortified margarine	1 T.	14	105	0.10			278			
Milk	1 cup	240	166	7.90	0.290	0.60	288	0.101	0.468	3.1
Egg	1	50	74	6.70	0.040	1.60	500	0.075	0.125	
			(639)	(25.05)	(0.435)	(4.61)	(1,066)	(0.423)	(0.847)	(46.1)
				Luncheon						
Vegetable soup	1 cup	218	31	4.70	0.020	0.20	432	0.094	0.070	7.0
Peanut butter sandwich	1½	131	450	17.00	0.063	2.10	323	0.396	0.216	3.0
Baked apple	1 medium	132	160	0.50	0.010	0.45	90	0.034	0.038	2.0
Milk	1 cup	240	166	7.90	0.290	0.60	288	0.101	0.468	3.1
Oatmeal cookies	2	46	200	4.60	0.024	1.10	230	0.096	0.072	
			(1,007)	(34.70)	(0.407)	(4.45)	(1,363)	(0.721)	(0.864)	(15.1)
				Dinner						
Tomato juice	½ cup	100	23	1.0			900			19
Beef loaf	1 slice	95	150	17.0	0.018	2.65	165	0.078	0.189	
Baked potato	1 medium	120	100	2.6	0.014	1.10	45	0.131	0.072	7
Carrots	⅝ cup	100	40	1.2	0.060	0.60	10,000	0.060	0.060	10
Mixed green salad	½ cup	75	50	1.0	0.015	0.64	1,300	0.088	0.072	15
Whole-wheat bread	2 slices	60	174	5.8	0.040	1.00		0.126	0.108	
Fortified margarine	1 T	14	105	0.1			278			
Gingerbread	1 piece	34	92	1.7	0.040	1.00	32	0.009	0.013	
			(734)	(30.4)	(0.127)	(6.99)	(12,700)	(0.492)	(0.514)	(51)
Totals			2,380	90.15	0.969	16.05	15,129	1.636	2.225	112.2
Recommended allowances for moderately active woman			2,500	60.0	0.8	12.0	5,000	1.5	2.2	70

QUESTIONS AND ACTIVITIES

1. What does the term "balanced diet" mean to you?

2. Write a typical breakfast menu for your family. To what type does this belong: light, medium, or heavy? Do all members of your family eat the same type breakfast? If not, explain the reasons for any differences. Why should one make a habit of eating breakfast? Is it desirable to skip any meals as a usual procedure?

3. Vegetable plates, supplemented with breadstuff and beverage and a suitable soup or salad or dessert, make satisfactory luncheon or supper menus. For each of the ten vegetable combinations planned in Activity 7, Chapter XI, list an appropriate soup, salad, dessert, or any two which complete the meal satisfactorily.

4. List soups to serve with a heavy dinner; a luncheon. List desserts and salads to serve with a heavy meal; with a light meal.

5. Plan meals of the following types.

Luncheon menus:
- soup, salad, breadstuff, beverage
- main dish, breadstuff, dessert, beverage
- salad, breadstuff, dessert, beverage

Dinner menus:
- soup, main course, salad, breadstuff, beverage
- main course, dessert, breadstuff, beverage
- main course, salad, dessert, breadstuff, beverage
- soup, main course, salad, breadstuff, dessert, beverage

6. Look up recipes for using leftover vegetables, fruits, cereals, and meats.

7. Using the score card, Table 36, for meal planning, score each of the meals listed on page 283. Do the same thing with the meals your family ate during the past week.

8. Following the suggestions of this chapter, plan one week's menus for your family.

9. Using the same idea as illustrated in Table 39, plan a day's menu, which will include the essential foods and meet the daily recommended allowances for specific nutrients, for yourself.

10. List the foods you ate at your last meal. Score this meal with Table 36.

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CHAPTER XXI

BUYING AND PREPARING FOOD

BUYING FOOD

Family Income and Food Budgets. Just what percentage of the family income shall be set aside for food depends on many things but chiefly on the amount of income. In general, the smaller the yearly income, the higher the percentage which must be allowed for food, if a good diet is to be had. As much as 50 to 60 per cent of low incomes may be required for food, somewhat less for higher incomes.

It has already been stated that almost two-thirds of the families in the United States have incomes of less than $1,500 a year in what could be considered ordinary times and only about one-fourth have incomes between $1,500 and $3,000. It is further recognized that the percentage of income spent for food is low in the United States in comparison with other countries.

Bureau of Human Nutrition and Home Economics studies of food expenditures in this country during 1935 and 1936 show that low-income family groups spent more than 40 per cent of their total expenditures for food; the higher income groups spent 25 per cent or less. With more money available to spend for food, more milk, butter, cream, eggs, meat, and succulent vegetables were bought than grain products, sugars, and other fats. It has been suggested by nutritionists that, were the benefits from nutrition on general well-being more generally appreciated, a larger share of the total family income might be allotted to food.

How Americans Spend Their Food Money. Studies made by the United States Bureau of Labor Statistics, by the United States Department of Agriculture, and by the New York Association for Improving the Condition of the Poor indicate that the typical American family spends its food money as indicated in column 2 of Table 40. In column 3 of the same table is a widely recommended food budget.

TABLE 40

FOOD BUDGETS

Foods	*Money Spent by a Typical American Family* *	*Suggested Food Budget for City Families* †
Meats and fish, including poultry and shell fish	25 to 35% of total money spent	⅕ or less
Eggs	5% of total money spent	
Milk, cream, and cheese	10% of total money spent	⅕ or more
Butter, other fats	10% of total money spent	
Sugar and other sweets	5% of total money spent	⅕ or less
Miscellaneous foods and food adjuncts	5% of total money spent	
Fruits and vegetables	15% of total money spent	⅕ more or less
Bread, cereals, and bakery products	15 to 20% of total money spent	⅕ or more

* H. C. Sherman and C. S. Lanford, *Essentials of Nutrition*, The Macmillan Company, 1943, page 329.
† *Ibid.*, page 335.

Protective Foods in Family Dietaries. The Bureau of Human Nutrition and Home Economics studies referred to earlier showed that the nutritive values of diets in the United States vary greatly since only one-fourth of the families studied had diets which could be rated good, more than one-third had fair diets, and another one-third had diets rated poor. The reason for this large number of diets that are not as good as they should be lies in the amount of protective foods used, the amounts making the difference between the poor, fair, and good diets.

Recommendations made by Mary Schwartz Rose regarding the percentage of total calories from milk, fruits, and vegetables (the protective foods) are shown in Table 41.

"The consumption of at least 10 to 20 per cent more milk, 10 to 25 per cent more butter, 25 to 70 per cent more tomatoes and citrus fruit, and about twice as much of leafy, green and yellow vegetables would be advantageous to the nutrition of our population." *

* "Are We Well Fed?" *United States Department of Agriculture Miscellaneous Publication 430,* Bureau of Human Nutrition and Home Economics, 1941.

TABLE 41

RECOMMENDED PERCENTAGE OF TOTAL CALORIES FROM FRUITS, VEGETABLES, AND MILK *

Age	*Percentage of Total Calories from Fruits, Vegetables, and Milk*
Children	
1–2 years	70–85
2–3 years	65–72
3–4 years	62–69
4–5 years	59–68
6–7 years	54–60
8–9 years	53–58
10–12 years	51–56
High school boys and girls	
At 2,000 calories	48–53
At 2,500 calories	42–45
Healthy adults, low to moderate incomes	28–30
Family of two adults and three young children on low to moderate income	37–42

* H. C. Sherman and C. S. Lanford, *Essentials of Nutrition*, The Macmillan Company, 1943. Page 340, Table 21.

Cost of Family Food Plans. The costs of two family food plans at September 1943 food price levels for different sized family groups are given on page 251.

Suggested Distribution of Food Money. Most families probably need to allot more of their family income for the purchase of food and also to distribute this food money more wisely among the various food groups. The suggested food budget in Table 40, page 288, is illustrated in the circle graph in Figure 36.

Dr. Sherman has further suggested a valuable guide for spending the food money at any level of expenditure as follows.* (1) At least as much money should be spent for milk (including cream and cheese) as for meats, poultry, and fish. (2) At least as much money should be spent for fruits and vegetables as for meats, poultry, and fish. This distribution "makes milk, fruits, and vegetables more prominent in the American dietary."

Factors Affecting the Cost of Food. An important consideration in the planning of meals and the buying of food is the cost of the raw food materials, the fuel consumed, and the

* H. C. Sherman and C. S. Lanford, *Essentials of Nutrition*, The Macmillan Company, 1943. Page 335.

time and labor involved in preparation. The problem of the cost of living becomes more serious every year. The former lower prices of food and fuel probably will not replace the present comparatively high prices. The only way to combat these

Divide your weekly food money into five parts:

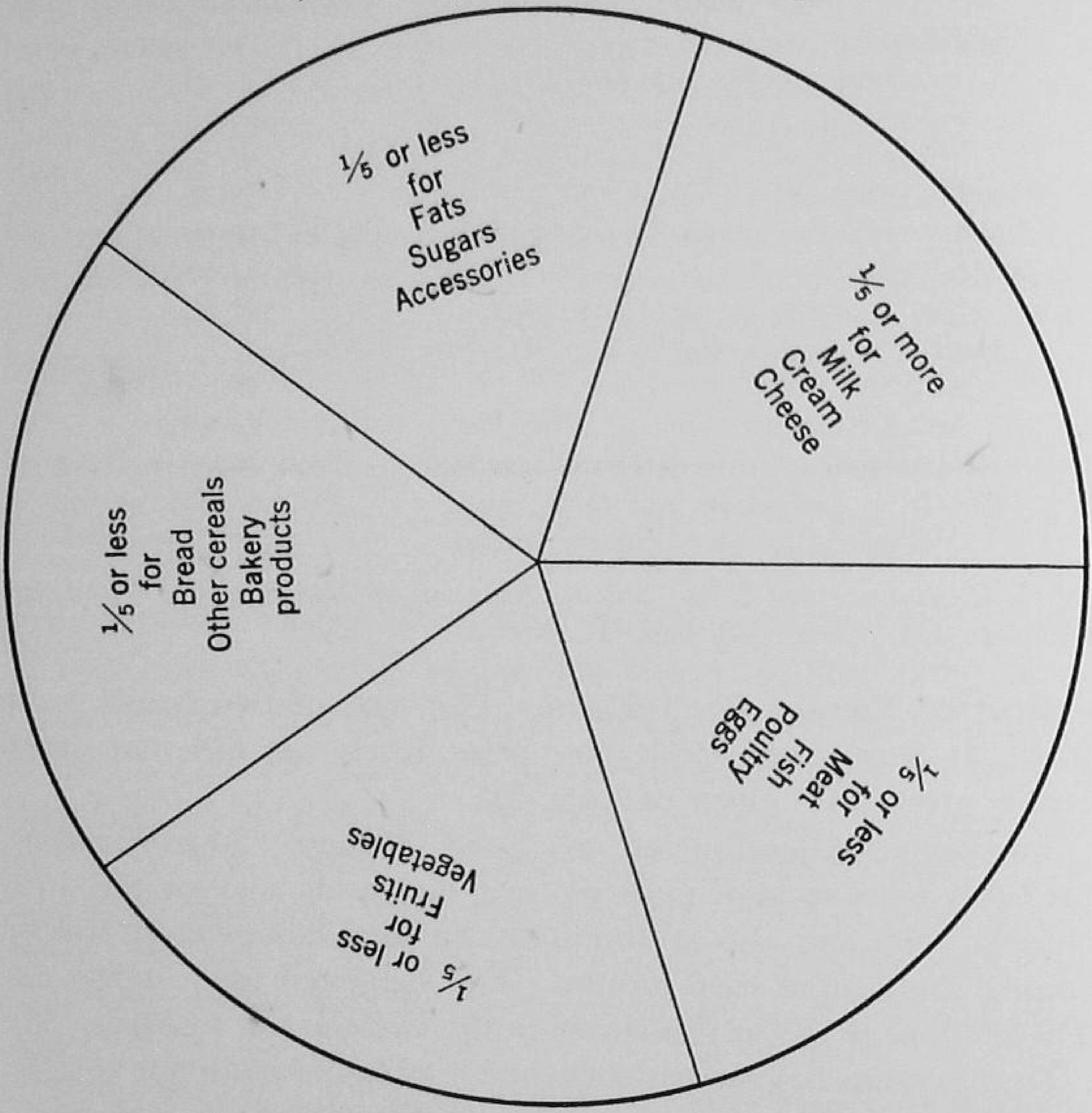

FIG. 36. Suggested food budget. *Food and Life*, United States Department of Agriculture, Yearbook 1939. Page 381.

conditions is through more careful and intelligent buying. By studying the market conditions and knowing the comparative values of foods, economies in buying, and methods of preparation, cheaper foods (equally wholesome and identical in nutritive value) may be substituted for the higher-priced ones.

The cost of food is affected by the following factors: the amount of labor and the cost of materials to produce a food; the cost of transporting it from its place of production to the

place where it is to be used; its perishability; whether the food is a highly advertised one; whether it is purchased in an independent, chain, or cash and carry store; fancy packaging; whether it is available in large or small units and in package or bulk; its esthetic appeal because of color, size, flavor, or texture; season; quality; supply and demand; and general market conditions.

Legal Protection for the Food Buyer. Certain federal, state, and municipal regulations have been formulated to protect the health and pocketbook of the buyer of foods. Some of these are obligatory and some are optional.

Obligatory Regulations. Legal standards for weights and measures have been established by the government. These regulate the sizes and contents of certain containers.

The Federal Food, Drug, and Cosmetic Act of 1938, which applies to foods passing in interstate commerce, regulates the cleanliness, wholesomeness, adulteration, mislabeling, misbranding, and misrepresentation of products. According to rulings of this act, labels on packaged products must indicate accurately the quantity of contents in measure or weight; the name and place of business of the manufacturer, packer, or distributor; the name of the food, if a federal definition and standard of identity has been established for the food, or, in case no such definition has been formulated, the common name of each ingredient; presence of artificial color (except in the case of butter, cream, and cheese), artificial flavoring, or any permitted chemical preservative; omission of any constituent of the food, as in dried milk where some of the fat is removed; and the presence of any substance used in place of the food (as cane sirup in maple sirup).

While the above act in no way makes compulsory the grading of canned goods, it does require that labels on canned goods shall be marked "Below U. S. Standard. Low Quality but not Illegal" or "Below U. S. Standard, Good Food, not High Grade" if the contents fall below the minimum standard of quality, condition, or fill of container. For example, a can of peas which meets all the standards except that they have been artificially colored will have to be marked as indicated above.

The Meat Inspection Act of 1906 insures the wholesomeness of all meat and meat products passing in interstate commerce. All such meats must carry the *round* purple stamp shown in

Figure 31, page 188, which indicates that the meat has been passed as being wholesome and fit for human consumption.

Additional Services for Buyers of Food. In addition to the legal obligatory safeguards for consumers just described, certain optional services provided by governmental, professional, or trade groups are available and assist the food buyer in one way or another. Until very recently, no buying guides were available to the consumer food buyer. The pure food legislation established certain standards, but not until the government formulated certain specifications to be met in buying foods for the government were any quality standards set up. Grades make possible the classification and standardization of many products on the basis of size, color, maturity, etc. Because of these and many other reasons, there has been a definite trend towards a more complete standardization and grading of food products.

Grades. Definitions for grades A, B, and C (official Federal Grades or National Standards) have now been established for a number of foods by the United States Department of Agriculture in cooperation with the commercial producers of these products. Foods for which such grades have been formulated include certain fruits and vegetables, meats, butter, and canned goods. At the present time, not a very large proportion of products on the market are government graded, but it is expected that more advantage will be taken of this service in the future by producers, manufacturers, packers, etc. Insignia for graded products include the certificates of quality in butter packages, the purple grade stamp (not the round purple inspection stamp), grade tags on poultry, and canned food labels showing grade; these and others are sometimes seen. Some states have also formulated standards and grades for certain of their own products.

It was said above that grading was optional. An exception needs to be noted in the ruling late in 1942 of the Office of Price Administration requiring all wholesalers of meats to grade beef according to United States Department of Agriculture grade specifications and to stamp once each wholesale cut with a designated grade mark.

Certificating agencies are also interested in giving approval to quality in foods. There are two types of these agencies, professional and commercial. The American Medical Association

is an example of an interested professional organization. Its Council on Foods, organized in 1930, allows the use of a Seal of Acceptance on certain foods which meet qualifications for wholesomeness, comply with the Pure Food, Drug, and Cosmetic Act, and carry only truthful advertising. *Accepted Foods,* a publication of the Council on Foods, lists the foods which have been accepted thus far.

Other certificating agencies of a nonprofessional nature include various magazine institutes, such as the Good Housekeeping Institute and the Parents' Magazine Institute and also the Consumer Service Bureau, Consumers' Research, Incorporated, and Consumers Union, all three of which are financed by membership fees. All of these agencies should be evaluated on the basis of their organization, qualifications of their staff, type of work done, and reliability.

Certain trade organizations have also established quality standards for food products. Consumers' Cooperatives grade canned goods and give additional services in the way of useful information regarding the can contents and use of their products. This same thing is done by Canners' Associations, chain store systems, and private organizations. Individuals in trade and industry also set up standards and give their products brand names which designate quality on the basis of their own qualifications. These brands may or may not correspond with government grades. They give no indication of grade to the consumer except that the higher grade is higher in price than the lower one.

How to Buy. "Good managers can secure much better diets for themselves and their families than others. Homemakers who are good managers and good cooks and who keep up-to-date on food values and nutrition can make their dollars count for more in the health of their families than those who do not know how to plan or buy food wisely. Large food expenditures do not always guarantee good diets." *

Suggestions for Buying. One of the secrets of being a good manager is to know how to buy. The following hints will help to bring full returns economically and nutritionally for the money expended.

* "Are We Well Fed?" *United States Department of Agriculture Miscellaneous Publication 430,* Bureau of Human Nutrition and Home Economics, 1941. Page 15.

Plan before you buy. (1) Plan menus for at least a full day ahead and preferably, in ordinary times, for several days ahead. Keep menus flexible so advantage may be taken of bargains. (2) Look over supplies and make a list of the items which are needed. (3) Whenever possible, shop in person and in the morning. An exception to shopping in person may be made in the case of staple goods requiring no inspection. Do not shop in rush hours. (4) Shop around to compare prices and learn where the best buys are to be had. (5) Buy staples in the middle of the week when the grocer is least busy. (6) Do not ask for more than one delivery per day. Wartime rationing of delivery service requires more careful planning. (7) Learn the seasons when different foods are the cheapest in price. (8) Learn which size orange is the best buy for juice, best size grapefruit for pulp, best size prunes for pulp, least expensive cuts of meats, and other similar economies. (9) Make point-rationed foods fit into balanced meals. Don't duplicate what can be purchased in fresh form.

Follow certain procedures when in the store. (1) Always ask prices before buying. (2) When buying packaged or canned goods buy by grade whenever possible; read labels carefully to note the grade, quantity, ingredients, suggested use, etc.; compare cost per ounce or pound in containers of different sizes. (Table 42 will be useful in this connection); buy in bulk if the food is offered in both bulk and packaged form and when savings and quality warrant it; buy in quantities when economies come that way and storage facilities permit; learn can sizes (see page 299); choose the size of can most economical for your own use. (3) When buying other products: buy by weight rather than measure or a dime's or dollar's worth; watch the scales to make sure how you buy; select fruits and vegetables yourself, when possible; buy eggs, meats, and other foods by grade, if possible; select foods in season for the best quality, flavor, and price; compute the price on individual food items to check with grocer's calculations; do not handle foods unnecessarily; learn the number of servings in one pound of various kinds of foods. (See Table 43.) (4) Economize in buying: buy a grade that's best suited for use, lower grades where appearance counts less, higher grades for better appearance and flavor; take advantage of bargains, odds and ends in canned goods, or fruits and vegetables over-

stocked by grocer; choose less expensive but equally nutritious foods as lower grades of eggs, canned goods, tougher cuts of meats, etc.; home-produced products are less expensive than ready-to-cook or ready-to-serve products (for example, cellophane packages of cut vegetables for soup or salad, pudding mixes, cake mixes, and biscuit mixes); economies can be effected by buying in stores where service charges are reduced to a minimum, such as in super markets and chain stores; choose less highly advertised brands, less fancy packages, and largest units. (5) Check food purchases before leaving store. (6) Compute food bill.

Follow these procedures after shopping. (1) Check articles purchased with bill. (2) Check weights of foods on your own scales occasionally. Report discrepancies to your grocer or butcher. (3) Store food carefully to retain freshness and nutritive value and prevent spoilage. Store tinned foods where they will not rust. Store glass-packed foods in a dry, cool, dark place. Keep dried foods in a cool, dry, dark place and in insect-proof containers. Keep frozen foods solidly frozen until needed. Keep foods high in vitamin G away from strong light. Store whole-cereal products in moisture- and insect-proof containers in a cool, dry, dark place. Store fats and oils in covered containers in a cool, dry place away from the light.

Special Considerations in Buying Canned Goods. *Information on Labels.* The following information must be stated on canned foods labels: name of product; net weight; name and address of manufacturer, packer, or distributor; presence of any preservative, coloring, or added substance; ingredients if no standard or definition has been formulated for the product. Additional information, not legally required but which may appear on the label, includes: the brand name, grade, can size, contents in cups, pieces, recipes, reason for the grade, if labeled, and government seals or seals of approval.

Can Sizes. Over twenty different can sizes have been used by commercial canners, some more frequently than others. The sizes and contents of the ones most frequently used are shown in Table 44.

Grades. The United States Department of Agriculture has formulated standards and grades for canned fruits and vegetables. Grades of fruits are based on quality, color, uniformity of size, and freedom from defects. Those for vegetables are based on

TABLE

COST-WEIGHT

(Determining cost per

How to determine cost per pound: Read the label on the can or package to learn weight of contents. If weight is stated in pounds or in fractions of a pound, reduce to ounces, remembering that there are 16 ounces in a pound. (Thus, 1 lb. 2 oz. is 18 ounces.) Find this figure in the first column, headed "Weight of Contents." Find the price you paid for the can or package in the top row of figures (as 16¢). Follow down the column of figures given under the price until you reach the line of figures extending to the right from the figure for weight of contents. This figure is the cost per

Weight of Contents of Package in Ounces	*Cost per Pound of a Product Which*											
	5¢	6¢	7¢	8¢	9¢	10¢	11¢	12¢	13¢	14¢	15¢	16¢
1	$.80	$.96	$1.12	$1.28	$1.44	$1.60	$1.76	$1.92	$2.08	$2.24	$2.40	$2.56
2	.40	.48	.56	.64	.72	.80	.88	.96	1.04	1.12	1.20	1.28
3	.27	.32	.37	.43	.48	.53	.59	.64	.69	.75	.80	.85
4	.20	.24	.28	.32	.36	.40	.44	.48	.52	.56	.60	.64
5	.16	.19	.22	.26	.29	.32	.35	.38	.42	.45	.48	.51
6	.13	.16	.19	.21	.24	.27	.29	.32	.35	.37	.40	.43
7	.11	.14	.16	.18	.21	.23	.25	.27	.30	.32	.34	.37
8	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30	.32
9	.09	.11	.12	.14	.16	.18	.20	.21	.23	.25	.27	.28
10	.08	.10	.11	.13	.14	.16	.18	.19	.21	.22	.24	.26
11	.07	.09	.10	.12	.13	.15	.16	.17	.19	.20	.22	.23
12	.07	.08	.09	.11	.12	.13	.15	.16	.17	.19	.20	.21
13	.06	.07	.09	.10	.11	.12	.14	.15	.16	.17	.18	.20
14	.06	.07	.08	.09	.10	.11	.13	.14	.15	.16	.17	.18
15	.05	.06	.07	.08	.09	.11	.12	.13	.14	.15	.16	.17
16	.05	.06	.07	.08	.09	.10	.11	.12	.13	.14	.15	.16
17	.05	.06	.07	.08	.08	.09	.10	.11	.12	.13	.14	.15
18	.04	.05	.06	.07	.08	.09	.10	.11	.12	.12	.13	.14
19	.04	.05	.06	.07	.08	.08	.09	.10	.11	.12	.13	.13
20	.04	.05	.06	.06	.07	.08	.09	.10	.10	.11	.12	.13
21	.04	.05	.05	.06	.07	.08	.08	.09	.10	.11	.11	.12
22	.04	.04	.05	.06	.07	.07	.08	.09	.09	.10	.11	.12
23	.03	.04	.05	.06	.06	.07	.08	.08	.09	.10	.10	.11
24	.03	.04	.05	.05	.06	.07	.07	.08	.09	.09	.10	.11
25	.03	.04	.04	.05	.06	.06	.07	.08	.08	.09	.10	.10
26	.03	.04	.04	.05	.06	.06	.07	.07	.08	.09	.09	.10
27	.03	.04	.04	.05	.05	.06	.07	.07	.08	.08	.09	.09
28	.03	.03	.04	.05	.05	.06	.06	.07	.07	.08	.09	.09
29	.03	.03	.04	.04	.05	.06	.06	.07	.07	.08	.08	.09
30	.03	.03	.04	.04	.05	.05	.06	.06	.07	.07	.08	.09
31	.03	.03	.04	.04	.05	.05	.06	.06	.07	.07	.08	.08
32	.03	.03	.04	.04	.05	.05	.06	.06	.07	.07	.08	.08

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TABLE *

pound of a product)

pound. For example, if a package weighs 18 ounces and its price is 16 cents, the cost per pound is 14 cents.

This table also may be used for determining cost per pint of liquid sold by the *fluid ounce,* since there are 16 fluid ounces in a pint. For example, if 2 fluid ounces of vanilla cost 23 cents, the cost per pint is $1.84.

Has Specified Price per Package

17¢	18¢	19¢	20¢	21¢	22¢	23¢	24¢	25¢	26¢	27¢	28¢	29¢	30¢
$2.72	$2.88	$3.04	$3.20	$3.36	$3.52	$3.68	$3.84	$4.00	$4.16	$4.32	$4.48	$4.64	$4.80
1.36	1.44	1.52	1.60	1.68	1.76	1.84	1.92	2.00	2.08	2.16	2.24	2.32	2.40
.91	.96	1.01	1.07	1.12	1.17	1.23	1.28	1.33	1.39	1.44	1.49	1.55	1.60
.68	.72	.76	.80	.84	.88	.92	.96	1.00	1.04	1.08	1.12	1.16	1.20
.54	.58	.61	.64	.67	.70	.74	.77	.80	.83	.86	.90	.93	.96
.45	.48	.51	.53	.56	.59	.61	.64	.67	.69	.72	.75	.77	.80
.39	.41	.44	.46	.48	.50	.53	.55	.57	.60	.62	.64	.66	.69
.34	.36	.38	.40	.42	.44	.46	.48	.50	.52	.54	.56	.58	.60
.30	.32	.34	.36	.37	.39	.41	.43	.45	.46	.48	.50	.52	.53
.27	.29	.30	.32	.34	.35	.37	.38	.40	.42	.43	.45	.46	.48
.25	.26	.28	.29	.31	.32	.33	.35	.36	.38	.39	.41	.42	.44
.23	.24	.25	.27	.28	.29	.31	.32	.33	.35	.36	.37	.39	.40
.21	.22	.23	.25	.26	.27	.28	.30	.31	.32	.33	.34	.36	.37
.19	.21	.22	.23	.24	.25	.26	.27	.29	.30	.31	.32	.33	.34
.18	.19	.20	.21	.22	.23	.24	.25	.27	.28	.29	.30	.31	.32
.17	.18	.19	.20	.21	.22	.23	.24	.25	.26	.27	.28	.29	.30
.16	.17	.18	.19	.20	.21	.22	.23	.24	.24	.25	.26	.27	.28
.15	.16	.17	.18	.19	.20	.20	.21	.22	.23	.24	.25	.26	.27
.14	.15	.16	.17	.18	.19	.19	.20	.21	.22	.23	.24	.24	.25
.14	.14	.15	.16	.17	.18	.18	.19	.20	.21	.22	.22	.23	.24
.13	.14	.14	.15	.16	.17	.18	.18	.19	.20	.21	.21	.22	.23
.12	.13	.14	.15	.15	.16	.17	.17	.18	.19	.20	.20	.21	.22
.12	.13	.13	.14	.15	.15	.16	.17	.17	.18	.19	.19	.20	.21
.11	.12	.13	.13	.14	.15	.15	.16	.17	.17	.18	.19	.19	.20
.11	.12	.12	.13	.13	.14	.15	.15	.16	.17	.17	.18	.19	.19
.10	.11	.12	.12	.13	.14	.14	.15	.15	.16	.17	.17	.18	.18
.10	.11	.11	.12	.12	.13	.14	.14	.15	.15	.16	.17	.17	.18
.10	.10	.11	.11	.12	.13	.13	.14	.14	.15	.15	.16	.17	.17
.09	.10	.10	.11	.12	.12	.13	.13	.14	.14	.15	.15	.16	.17
09	.10	.10	.11	.11	.12	.12	.13	.13	.14	.14	.15	.15	.16
.09	.09	.10	.10	.11	.11	.12	.12	.13	.13	.14	.14	.15	.15
.09	.09	.10	.10	.11	.11	.12	.12	.13	.13	.14	.14	.15	.15

tenderness and maturity, uniformity of size and color, freedom from defects, flavor, and clearness of the liquid.

The use of the government grading system by the canning industry is optional. A further service of continuous inspection by government officials in canning factories is also optional. If canned goods are graded according to government standards, they may be labeled Grades A, B, or C. If they are canned under continuous inspection, they may be labeled U. S. Grade A, U. S. Grade B, or U. S. Grade C. In addition, these latter may carry the continuous inspection seal of the United States Department of Agriculture.

TABLE 43

Number of Servings in One Pound of Various Foods *

Food	*Servings in One Pound*	*Food*	*Servings in One Pound*
Apples	3 to 4	Fish, fillets	4
Apricots, dry	20 to 25	Grapefruit	2
Asparagus	3 to 4	Ground meat	4 to 5
Bacon	8 to 10	Ham	3
Bananas	3 to 4	Lettuce, head	5
Beans, Lima in pods	2 to 3	leaf	8
dry	8 to 10	Onions	3 to 4
Navy, dry	8 to 10	Oranges	3 to 4
snap, fresh	3 to 4	Peaches	5 to 6
Beets	3 to 4	Pears	3 to 4
Broccoli	2 to 3	Peas, in pods	2 to 3
Brussels sprouts	5 to 6	Peas, dry	8 to 10
Cabbage	3 to 4	Potatoes	3 to 4
Carrots	4	Poultry	2
Chops, lamb	3	Prunes	10 to 12
pork	4	Rhubarb	4
Cranberries	6 to 8	Roasts, with bone	2
Eggplant	5 to 6	boneless	4
Fish, with bone	2	Spinach	2 to 3
		Turnips	3 to 4

* "Food and Home Notes," United States Department of Agriculture, September 18, 1943. Courtesy, Bureau of Human Nutrition and Home Economics.

United States grades for fruits include U. S. Grade A or Fancy (excellent in all respects with a heavy sirup, approximately 55 per cent); U. S. Grade B, also called Choice or Extra Standard (fine in all respects with a 40 per cent sirup); U. S. Grade C or

Standard (good in all respects with a 25 per cent sirup); Substandard (lower than minimum grade for Standard with water pack or a 10 per cent sirup).

Vegetables may be graded U. S. Grade A or Fancy (excellent in all respects); U. S. Grade B, also called Choice or Extra Standard (fine in all respects); U. S. Grade C or Standard (good in all respects); Substandard (less than minimum grade for Standard).

TABLE 44

CAN SIZES COMMONLY IN USE *

Food	*Name of Can*	*Approximate Weight*	*Approximate Cups*
Fruits and vegetables (tin cans)	No. 1 tall	1 lb.	2
	No. 303	1 lb.	2
	No. 2	1 lb. 4 oz.	2½
	No. 2½	1 lb. 12 oz.	3½
	No. 10	6 lb. 10 oz.	13
Juices (tin cans)	No. 2	1 pt. 2 fl. oz.	2½
	303 cylinder	1 pt. 4 fl. oz.	2¾
	No. 2 cylinder	1 pt. 8 fl. oz.	3
	No. 3 cylinder	1 qt. 14 fl. oz.	5¾
Vegetables (glass jars)	No. 303	1 lb.	
Fruits (glass jars)	No. 2½	28 oz.	3½
Any food in tin cans	No. 3	33 oz.	4
	No. 5	3 lb. 8 oz.	7

Note: To compute the approximate number of cups in different sized cans, divide the number of ounces (either weight or fluid) given on the label by 8.

* Adapted from *To-day's Canned Foods*, National Canners Association.

Types of Labels for Canned Foods. Brands. Canned foods have always been distinguished by brand labels. A canned foods manufacturer gives his highest quality product one brand name, his second quality another name, and his third quality a still different name. These brand names always indicate to the manufacturer first, second, and third quality. However, these coined names are not very helpful to the consumer buyer in indicating quality. Consequently, a movement has been on foot for the grade labeling of canned foods by either a letter (A, B, C) or number (1, 2, 3). Much controversy has arisen over this grade

labeling of canned foods. Grade labeling of canned foods has been compulsory in Canada for a number of years, with designations of Fancy, Choice, and Standard to indicate first, second, and third.

Descriptive labels. Since brands do not give any information regarding the quality of the contents of the can (and there was opposition to the elimination of brand names), a label retaining the name of the brand and adding information about the quantity in household measures, number of pieces, possibly the size of the food, such as the sieve number for peas, and directions for use was suggested to meet temporarily the demand for more label information. This type of label, called descriptive, has been widely used, but it still does not indicate to the consumer anything about the quality of the product.

Informative labels. An "informative" type of label, describing differences in quality, has been suggested by the National Consumer-Retailer Council, Inc. A combination of this type with the descriptive is seen on some cans. Labels on goods canned for Consumers' Cooperatives and certain large chain organizations carry letter grades, explanation of the grades, and other descriptive material. Labels which meet the approval of the National Consumer-Retailer Council, Inc., "must give on the front panel the grade of the product in terms of A, B, or C as defined by the United States Agricultural Marketing Service in addition to the information required by the Federal Food, Drug, and Cosmetic Act. The back panel must carry some interpretation of grade difference (such as a grade scoring table and comparable facts with regard to permitted defects; size and/or number of pieces designated in standard terms; amount in cups; and density of sirup. The addition of appropriate recipes, dietary facts, descriptive terms, and promotional material is optional." *

Figure 37 shows a type of label suggested by the National Consumer-Retailer Council, Inc.

Canned Meats and Fish. No federal grades have been established for canned meats. However, canned meats entering interstate commerce are subject to the federal meat inspection for wholesomeness.

* *National Consumer-Retailer Council, Inc., Special Report 15.* February 10, 1941.

Industry grades have been established for tuna and salmon as follows.

	Grades				
	1st	2nd	3rd	4th	5th
Tuna	White meat	Light meat	Tonno-Italian style pack		
Salmon	Chinook	Red or Blueback Sockeye	Coho	Pink Humpback	Chum or Dog

Most preferred salmon is graded for color, texture, and flavor.
Sardines graded according to size and number in the can.

Shrimp packers may avail themselves of an inspection service provided by the United States Department of Agriculture, in-

FIG. 37. Informative label approved by the National Consumer-Retailer Council, Inc. Courtesy, Kroger Grocery and Baking Company.

stituted in 1934. Any other packers of fish may also use this service. If any products are inspected under this service, they may carry the following on their labels: "Production Supervised by the U. S. Food and Drug Administration."

Using Canned Goods. Any cans of foods with bulging ends, known as "swells," should be discarded. The idea that foods spoil when left in opened cans has no foundation. It may even be safer to store unused portions in the can in the refrigerator than to remove the contents to other containers. However, a refrigerator full of opened, partly filled tin cans may not represent very high housekeeping standards.

All liquids from any canned foods should be utilized in some way as they contain some of the nutritive value of the product.

The various grades of canned foods are equally wholesome although they may differ in appearance and in price. The price differences are caused by the differences in appearance, color, flavor, etc. Economies may be effected by buying the lower grades of canned foods for dishes where the original appearance of the food is unimportant, as in soups, creamed dishes, soufflés, scalloped dishes, and salads. The higher grades may be desired where the food is to be served as it comes from the can, as in the case of stewed tomatoes, fruits as desserts, etc.

PREPARING FOOD

Cooking, the First Step in Making Most Food Available to the Body. In order to become available to the body, food must undergo certain physical and chemical changes. These changes are brought about by such processes as cooking, digestion, absorption, and metabolism.

Cooking Defined. Cooking is the preparation of food by the application of heat. Historically, the cooking of food dates to the discovery of fire. However, it is probable that the actual application of heat to food really preceded this discovery, as we are told that primitive man placed his food on or between stones which had been made hot by the sun.

Following the discovery of fire, the first method of cooking no doubt was baking, by which the food was placed on stones made hot by fire. Boiling may have developed next, the hide of the meat being used to hold the water which was heated by dropping hot stones into it. With the origin and improvement in the making of pottery and tools, cookery processes developed to the stage we know today.

Purposes of Cooking. The cooking of food is necessary for several reasons: to increase the wholesomeness of food by destroying harmful bacteria and parasites which may be present in it; to improve the taste and flavor of the food, thereby increasing its palatability; to increase the digestibility of food by breaking down the cellulose, softening and bursting the walls of the starch grains, and making meats more tender.

Effects of Cooking. The application of heat to food affects it in many ways. The protein is coagulated at a fairly low temperature, 180°. On long cooking at high temperatures, it be-

comes hardened and toughened and difficult to digest. Certain chemical changes may also take place during the heating of this substance; cooked egg white, for example, is more digestible than raw.

The starch present in food as small, dry grains is insoluble in cold water and difficult to digest. Cooking changes the form of the starch and increases both its flavor and digestibility. When dry heat is applied, as in toasting bread, the starch is broken down into a more easily digestible form of carbohydrate called dextrin. Cooked with moist heat as in cereals and starchy puddings, the starch grains absorb liquid, swell, soften, and burst.

Ordinary cooking processes affect sugar very little except to convert it into invert sugar, a combination of glucose and fructose. When sugar is subjected to dry heat, it changes first into barley sugar and then into a brown liquid, caramel, which is used in flavoring puddings and sauces and in adding color to gravies and soups.

Most fats are not affected by ordinary cooking processes, but, if heated to a very high temperature, they will decompose. The decomposition products formed impair the flavor and are very irritating to the alimentary tract.

Cellulose, the fibrous part of the plant foods, is softened by the right methods of cooking, and the connective tissue of meat is sometimes dissolved.

Since some foods lose a considerable amount of their mineral value in cooking, it is considered desirable that as many as possible of the fruits and non-starchy vegetables be eaten raw. Most of our food requires cooking, however. Therefore, the choice of the best method becomes extremely important.

The loss of food value in cooking any food is more or less dependent upon its solubility in water. Flavoring substances, mineral salts, and vitamins are dissolved in the water when fruits, vegetables, and meats are cooked by boiling. Exposure to air during cooking still further destroys vitamin content as well as does the addition of baking soda to the cooking water.

Accepted General Cooking Procedures. In general, conditions which aid in the retention of color, aroma, flavor, form, and texture in the handling and preparation of foods also help to retain the nutritive values. If the vitamin C content can be retained, most of the other values and desirable qualities can be

also. The observance of the following general procedures in preparing and cooking foods is desirable to insure the retention of the maximum amount of nutritive values: as short cooking as possible for all foods; low temperatures for meat, eggs, and cheese dishes; foods served as soon as cooked; dried foods cooked in the water in which soaked; canned foods opened just before use; use made of liquids from all canned products; cooking of frozen foods started while foods still frozen; short cooking period in pressure saucepan in preference to long period in pressure cooker; no incorporation of air into foods while they are cooking by stirring, sieving, or straining while hot; left-over vegetables served in salads or other forms requiring no reheating; cooking of all foods to be boiled started in boiling water and the water returned to boiling as quickly as possible; foods peeled as thinly as possible; thorough cleaning out of all utensils used in food preparation; observance of correct cooking procedures so that no food is wasted because of being made unpalatable.

QUESTIONS AND ACTIVITIES

1. Using one of the family food plans, Tables 28 and 29, determine the food your family needs for one week. Translate this weekly food-needs list into a weekly market order. Determine how much this market order costs in your locality, observing all possible economies in selecting the foods.

2. With a circle graph, similar to Figure 36, page 290, show the way the cost of your market order is distributed among the various food groups. How does yours compare with the suggested one? As another check, was as much money spent for milk, including cream and cheese, if purchased, as for meats, poultry, and fish; as much for fruits and vegetables as for meats, poultry, and fish?

3. What differences in cost would you expect to find when buying in an independent store? A chain store? A super market?

4. Compare the cost per ounce of the following foods: (*a*) mayonnaise in 1-pint, ½-pint, and 3-ounce sizes; (*b*) vanilla in two bottles of different size; (*c*) cereal in box and cereal in cellophane package; (*d*) grapefruit pulp in grapefruit of different sizes; (*e*) orange juice in oranges of different sizes and cans; (*f*) grapefruit pulp, fresh and canned; (*g*) cooked cereal and uncooked cereal; (*h*) homemade chocolate pudding and pudding made from prepared mix.

5. Compare the cost per pound of the following: (*a*) flour in 25-pound, 12½-pound, 5-pound, and 2-pound bags: (*b*) edible portion of

fresh peas in pod, fresh-shelled peas, canned peas, and frozen peas; (*c*) sugar in 25-pound, 10-pound, 5-pound, and 1-pound amounts.

6. Determine what is the cheapest way to buy a quart of whole milk (canned, dried, etc.).

7. Compare the cost of several sources of any one of the nutrients as illustrated below for vitamin C.*

Orange juice, ½ cup (1½ medium oranges at ——¢ a doz.) would cost ——¢.
Canned grapefruit juice, ½ cup (4 oz.) at ——¢ a can (—— lb. —— oz.) would cost ——¢.
Canned tomatoes, 1 cup (8 oz.) at ——¢ a can (—— lb. —— oz.) would cost ——¢.
Strawberries, raw, ⅕ lb. (⅛ qt. at ——¢ a qt.) would cost ——¢.
Cabbage, white, raw, ⅓ lb. at ——¢ a lb. would cost ——¢.
Turnips or rutabagas, raw, ⅓ lb. at ——¢ a lb. would cost ——¢.

8. Make up a list of staple supplies for the kitchen cupboard. Secure the price of this list of foods in an independent store, a chain store, a super market, or any other type of store in your community.

9. What is the weekly requirement for milk (in quarts) for your family? How much would this cost if you purchased Grade A milk? Grade B milk? Evaporated milk? Half fresh and half evaporated milk? Dried milk?

10. List and give examples of all the desirable effects that are brought about by the cooking of foods.

11. List and give examples of all the undesirable effects that are brought about by the cooking of foods. How can each of these effects be prevented or lessened?

12. Collect labels which illustrate each of the obligatory and each of the optional label statements.

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UNIT FOUR

NUTRITION FALLACIES

CHAPTER XXII

FADS AND FALLACIES IN FOOD AND NUTRITION

Origin of Fallacies. The old saying that "a little knowledge is a dangerous thing" very aptly explains many of the queer and vague ideas concerning food which appear from time to time without rhyme or reason. Because of their inability to be explained scientifically, they may rightly be called fallacies. Some have been handed down from one generation to another, others have arisen with each new discovery regarding food and nutrition, many have been the result of commercial advertising of products, and a large share are consciously promoted by the group of people known as food faddists. To the uninformed, the very dramatic and "scientific-sounding" explanations offered for these ideas by everyone but the person who really knows are so impressive as to leave no doubt in the mind of their validity.

The purpose of this chapter is to point out some of these more common and popular fallacies and attempt to show their lack of sound scientific basis.

"Health-Food" and "Health-System" Fallacies. Unwarranted claims for the health-giving properties of certain foods or systems of living are frequently heard. The misleading use of the word health in connection with a food or feeding regime is condemned by the United States Food and Drug Administration and the Council of Foods of the American Medical Association. The latter defines the proper use of the terms health, healthful, and wholesome as follows: *

The term *health food* and equivalent claims or statements to the effect that a food gives or assures *health* are vague, misinformative, and misleading. An adequate or complete diet and the recognized nutritional essentials established by the science of nutrition are necessary for health, but health depends on many other factors than those provided by such diet or nutritional

* Courtesy, Council on Foods, American Medical Association.

essentials. No one food is essential for health; there are no *health foods*. Statements of well-established nutritional or physiologic values of foods are permissible.

The term *healthful* is frequently encountered in food advertising. As used, it commonly means that the food described corrects a possible nutritive deficiency or some abnormal condition in such a manner as actively to improve health. It incorrectly implies that the food possesses unique (or unusual) health-giving properties. The term has a popular specific *health food* significance which makes its use in advertising misinformative and misleading.

Healthful and *wholesome* by dictionary definition have almost identical meanings; the former, however, intimates an active significance, whereas, the latter signifies quality or condition. *Wholesome* indicates that a food so described is sound, clean, fit for consumption, and free of any objectionable qualities; it is appropriate for characterizing foods fulfilling these qualifications and should replace *healthful* as used in food advertising.

Food-Combination Fallacies. Perhaps the most numerous and also the oldest are those fallacies concerning the combination of certain foods. Of these the shellfish-ice cream combination is notorious. The idea that these two foods could not be eaten in the same meal probably arose in one of several ways. Before present-day excellent sanitation and methods of refrigeration, either improperly refrigerated and spoiled shellfish or refrozen and repacked melted ice cream may have explained cases of illness occurring after meals containing these two foods, and such a result may have been accepted as the usual consequence of such a combination. Another explanation may be the fact that certain individuals have an idiosyncrasy (commonly called allergy) for shellfish; that is, they are sensitive to it. Such a person will always be made ill by the food alone or in any combination. The average person, unlike the scientist who bases his conclusions, not on personal but objective observations and not on one but many, accepts such an instance as an established fact for all individuals. Underlying this fallacy is, of course, the assumption that the protein of shellfish and that of milk do not "mix," but science gives us no explanation why the protein of milk will combine any less readily with that of shellfish than with that of meat or eggs, all from animal sources. Certain religious beliefs may prohibit the combination of flesh and milk, but there is no scientific explanation to corroborate it.

Another popular combination fallacy concerns the consumption in the same meal of an acid fruit, tomatoes most often mentioned, and milk, the reason being the curdling effect of the acid on the milk. The facts are that milk comes into contact with acid when it reaches the stomach, where the hydrochloric acid of the gastric juice is mixed with it. It is even thought now that milk to which acid is added forms smaller curds in the stomach and is more easily digested, and this is one reason why baby specialists sometimes advocate the addition of an acid, lactic or citric, or a fruit juice, orange or tomato (containing citric acid), to the formula given even to a young baby.

Two variations of a more or less recent and very popular food fad tell us that we must eat in the same meal neither a combination of an acid and a starchy food (which would eliminate fruit or toast or cereal at breakfast) nor a combination of a protein and a starchy food. The former is fantastically explained by the food faddist on the basis that acid will cause starch to "explode" in the stomach; or his explanation, savoring of scientific terminology, points out that the starch-digesting enzyme, ptyalin, is destroyed by the acid. This latter statement probably is true, but the faddist fails to recognize a further fact, that not all the starch is digested by ptyalin in any event. The enzyme amylopsin of the pancreatic juice will complete the digestion when starch reaches the small intestine, where the acids will be neutralized by the alkaline medium.

As to the second tabooed combination, that of protein and starch, the faddist explains the lack of wisdom in this mixture to be based on the opposition in the optimum conditions for protein and starch digestion, the former requiring an acid and the latter an alkaline medium. So far so good, again; but once more are overlooked further facts: (1) ptyalin mixed with the starch in the mouth continues to act while the food remains in the upper portion of the stomach which secretes little acid (most acid being secreted in the lower portion); (2) as mentioned above, carbohydrate digestion may be completed in the intestine, and (3) many foods, as bread, potatoes, oatmeal, peas, etc., contain both protein and starch but still are completely digested. Science has also answered this fallacy in experiments with the feeding of meat and potatoes, alone and in combination, to both well and sick persons with the result that the combination of the two

took so little more time for complete digestion than either alone as to be unimportant.

Reducing Fallacies. Most dangerous to health, probably, are those fallacies concerning the loss of weight, the need for which should be determined by the physician, rather than fashion, and the diet by the nutritionist, rather than by commercial and radio sources. A correct reducing regime includes attention to the diet and to carefully prescribed exercise. The reducing diet differs from the regular diet only in calories, about 500 to 800 less, which the person obtains by burning his own stored fat, and it must be fully adequate in protein, minerals, and vitamins.

Reducing fallacies are concerned with four types: freak diets, laxative substances, drugs, and dietary supplements. Examples of each of these have appeared from time to time and are undesirable for one reason or another. The special "reducing" diets are all apt to be extremely deficient in necessary food essentials and may, in some cases, lead to disastrous results. Though the banana and milk diet which once appeared for reducing weight is probably more nearly adequate than those mentioned, a much more satisfying and palatable reducing menu could be planned and would accomplish the same results with less discomfort.

Laxatives as reducing substances are advertised as such for this purpose or are the main ingredient in frankly advertised reducing remedies. These act by hurrying the food along the intestinal tract and out of the body before it has had time to be absorbed and utilized. Their use has serious consequences both by depriving the body of the nutriments it needs (even though eaten) in the way of protein, minerals, and vitamins and also in the overstimulation and irritation of the intestinal walls and, if the substance happens to be salts, by the withdrawal of fluids from and the drying out of the tissues.

Drugs used for reducing purposes, which appear in the reducing products on the market, include thyroid extract and dinitrophenol. These drugs act by speeding up the oxidative processes in the body and the breakdown of fatty tissue and, because of their effects on the heart, pulse, etc., should never be used except on the advice of a physician.

Most of the dietary substances offered for sale for reducing purposes are ineffective. They are usually accompanied by a

reducing regimen (good or bad) which may be effective but is not essential to the reducing program.

There are no short cuts to reducing, and no freak diets or advertised reducing substances should ever be used for the purpose of reducing weight. The greater increase in the number of cases of tuberculosis in young women than in any other age group has been reported since so much has been said and written about losing weight as the result of the fashion for slimness.

Fallacies Concerning Acidosis. The term acidosis has acquired such a magical connotation in the mind of the average person that it is used, without any sense of its true meaning, to explain all causes and results of every kind of condition, including acid stomach, acid blood, etc. Correctly used, acidosis refers only to a condition of the blood where the reaction is changed from its usual very slightly alkaline state to a very slightly acid state. (A great change toward the acid side would cause death.) That this change may be brought about by the predominance of acid-forming foods in the diet is questionable as well as its undesirable effects if it does occur. Lack of carbohydrate in the diet or the inability of the body to burn carbohydrate, as in the disease diabetes, may also cause acidosis. True acidosis is a medical, not a nutritional, problem. In the absence of this foodstuff or its oxidation, fat cannot be burned to its final end products of carbon dioxide and water, the oxidation of fat stopping at the so-called acetone stage and the acids formed remaining in the blood and tissues. This is the reason why carbohydrate foods should never be entirely eliminated on a reducing diet.

The term acidosis is wrongly used to indicate too much acid in the stomach, there being no connection with stomach acidity and blood acidity. Citrus fruits, as mentioned in Chapter X, would still be acid in the stomach, but after absorption and oxidation would leave an alkaline residue which helps to neutralize the acid-forming elements in the blood.

Fallacies Concerning Roughage. As has been mentioned several times throughout the book, a certain amount of natural bulk or cellulose in food is essential for the proper functioning of the intestinal tract. However, persons vary in the amount of roughage they can tolerate. Therefore the endeavor to eat all skins of foods, raw foods in large amounts, all whole grains,

and possibly additional bran may be undesirable for some people. Raw and cooked foods, foods with and without roughage, and refined and whole-grain cereals have a place in the diet, but not one or all should be stressed to the exclusion of others.

Other Fallacies. A very common fallacy has to do with the importance placed, mainly by manufacturers of food products, upon one food or one type of food as the all-important article of diet. There is no one perfect food. Even milk, although usually so considered, is low in iron and some of the vitamins. This fallacy has won for itself the name of the "one-type-food" fad or the "eat-more" fad. Only by the proper combination of foods in the diet as discussed in Chapter XVIII will the nutritional requirements be met, no one food being able to do everything. Variations of this fallacy include the popular idea that fish is a brain food and celery a nerve tonic; that only brown sugar, molasses, and honey should be used for sweetening and whole grains and their products always in place of any refined; also that "alive" foods, or those grown, should be used practically to the exclusion of those which are "denatured," or refined, and that juices squeezed from raw vegetables possess properties which will do anything from making one grow beautiful to preventing and curing diseases for which no cures have yet been found in medicine.

The adequacy of a strictly vegetarian regime is another fallacy. If by vegetarianism is meant the exclusion of all animal foods, including milk and eggs, although the vegetarian will usually admit that he does drink milk, the protein will be inadequate in kind, in amount, and possibly in some of the minerals unless the foods are most carefully chosen. Vegetable protein lacks certain essential amino acids. In order to meet the need for this foodstuff from vegetable (plant) sources alone, the bulk would be so great as to make it impossible to eat and take care of the amount of food necessary.

Still another fallacy concerns the "fattening" effect of certain foods. No food can really be said to be fattening when taken as a part of the whole required amount, but any food eaten over and above the body's requirement will furnish additional calories which are not needed.

Combating Fallacies. With the increased knowledge offered as a part of nearly all present-day school training, it is to be

hoped that the generation of today, as well as that of the future, will prove itself less gullible and more capable of intelligently evaluating food and nutrition information from all sources as well as the status of the proponents of so-called food fads.

Evaluation of Printed Material. The following check list may be useful in evaluating and making intelligent use of printed material.*

CHECK LIST

To Help Teachers, Students, and Club Leaders Evaluate and Make Intelligent Use of Commercial Materials.

This check list is intended for the use of teachers and club leaders in evaluating such materials as booklets, charts, posters, films, and recipe filing cards. These may be useful for their own reference, in the classroom, or for adult classes and clubs.

Any one piece of the material will not necessarily check on all of the points listed but may nevertheless be valuable for certain purposes. The relative importance of each of the points depends on the way the commercial material is to be used. For example, a teacher might find that material which is scientifically accurate and therefore valuable for her own reference is not suitable for classroom use because it is hard to read and cluttered with irrelevant material; or a club chairman might find program suggestions in material which is graphically presented but may be prevented by club rules from distributing it at a club meeting because of its brand advertising.

The purpose of this check list is not to give a numerical rating to educational and informational materials but to direct attention to certain desirable features. Reference to the check list may sharpen critical faculties and indicate important points to be considered and standards to be maintained. In this way the check list may serve as a useful tool in selecting and evaluting commercial materials.

I. Accuracy of Subject Matter
   - Free from half truths
   - Free from exaggerated statements
   - Backed by standard laboratory tests
   - Backed by recognized authorities
   - Backed by signature of author and his professional title
   - Backed by name of firm or organization publishing it

* "Report of the Committee on Educational Use of Commercial Materials," *Bulletin of the American Home Economics Association, Series 23, No. 1,* September 1940.

II. Timeliness of Subject Matter
- Furnishes the most recent information
- Gives date of publication
- Meets the needs of the times
- Adds information to that available in most textbooks

III. Methods of Presentation
- Factual, not cluttered with irrelevant material
- Well organized
- Simple, clear, brief
- Attractive in format
- Durable
- Graphic, well illustrated
- Easy to read, sight saving
- Appropriate for group for which it is intended

IV. Subject Matter Unbiased
- Clear-cut educational purpose
- Information about products in general rather than promotion of specific brands
- Free from advertising in text
- Posters and charts free from advertising

QUESTIONS AND ACTIVITIES

1. Prepare an exhibit of all the so-called health magazines. Note the editors, the usual writers, and the type of articles which appear in these magazines. Try to learn something about the professional standing of the editors and writers. Study the articles in these magazines with a view to evaluating for accuracy and authoritativeness the information presented concerning foods and nutrition.

2. Collect all possible advertisements dealing with foods, health, and nutrition. How many give misleading nutrition information? How many make unwarranted claims for vitamins and minerals? How many make unwarranted claims for certain food products or combinations of foods? Display material relative to food fads as an exhibit.

3. Obtain copies of as many freak reducing diets as possible. Study the nutritional deficiencies in each of these and explain why the following of each would be dangerous from the health standpoint.

4. Make a list of all the authentic nutrition information which helps to explain why the so-called food fads are really fads or fallacies.

5. Collect from commercial sources all possible types of materials, as booklets, folders, charts, posters, etc., on food and nutrition. Study this material with the check list on pages 313–314 and write up the results of your study.

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APPENDIX

Nutritive Value of Foods *

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Almonds	100	¾ c. or 107	647	21.0	54.9	17.3	.24	.47	4.1	75	.225	.300	1.82	0	2.7
Apples, fresh	100	⅔ of 2¾″ diam. or 1, 2″ diam.	60	.3	.4	13.9	.01	.01	.4	75	.035	.010	.5	6	1.0
Apple sauce †	100	⅜ c.	124	.4	.5	30.1	.01	.02	.4	71	.027	.03		4	.6
Apricots, fresh	100	2, 1⅝″ diam.	54	1.0	.1	12.3	.01	.03	.6	4,000	.045	.105		7	.6
Apricots, dried	100	½ c. packed or 16 small halves	268	4.7	1.0	60.1	.07	.12	7.6	6,000	.090	.100		2	3.2
Apricots, dried, cooked †	100	⅓ c.	128	1.3		30.7	.02	.03	2.0	2,948	.015	.075		1	
Artichokes, globe or French	200	1, 3″ diam. 4″ long	100	5.8	.8	17.4	.04	.09	.9	200	.075	.030		9	3.2
Artichokes, Jerusalem	100	2 medium	74	2.2	.1	16.2					.060			7	.8
Asparagus, fresh	100	12, 5-inch stalks	24	2.2	.2	3.2	.03	.04	1.0	bleached 0–50 green 900	.180	.120		bleached 30 green 40	.7
Avocados	100	½, 4″ long	244	2.0	23.2	6.7	.05	.05	.6	125	.090	.090		10	1.8
Bacon, uncooked	100	10 slices, 1½″ × 4½″ × ⅛″	625	10.5	64.8	—	.01	.11	1.3	0	.099	.075–.125	4.4	0	
Bacon, cooked	15	4 strips, 3¼″ long	77	2.5	7.5	—	0	.03	.3			.105			
Bananas	100	1, 6½″ long, or ¾ c. sliced	96	1.2	.2	22.4	.01	.03	.6	350	.050	.075	.61	10	.6
Barley, pearled	100	½ c.	355	8.5	1.1	77.8	.02	.18	2.0	0	.180		2.75	0	.8
Beans, fresh, Lima	100	½ c.	125	7.5	.8	22.0	.03	.13	2.4	300	.300	.175	.29	30	1.5
Beans, fresh, snap, green	100	⅔ c.	37	2.4	.2	6.3	.05	.05	1.0	1,000	.075	.110	.64	25	1.4
Beans, fresh, snap, wax	100	⅔ c.	37	2.4	.2	6.3	.05	.05	1.0	300	.075	.100	.76	25	1.4
Beans, fresh, soy	100	+½ c.	155	12.4	6.3	12.2	.08	.22	.3	200	.500	.300		40	1.5

* M. S. Chaney and M. Ahlborn, *Nutrition*, Third Edition, Houghton Mifflin Company, 1943. Pages 390–411. Reprinted by permission.
† Vitamin A, thiamin, riboflavin, and ascorbic acid content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Beans, dried, kidney	100	½ c.	350	22.0	1.5	62.1	.16	.47	7.9		.480	.324	2.82	0	3.9
Beans, dried, Lima	100	⅔ c.	349	18.1	1.5	65.9	.07	.34	8.6	100	.525	.750	1.83	0	4.3
Beans, dried, navy	100	½ c.	327	22.5	1.8	55.2	.16	.47	7.9		.480	.324		0	3.9
Beans, dried, soy	100	½ c.	417	36.7	18.2	26.6	.21	.58	.8	100	1.200	.750	4.32	0	5.0
Beans, canned, baked	100	½ c.	118	6.9	2.5	17.1	.04	.34	2.1	55	.132	.102		—	1.0
Beef bouillon	100	½ c.	18	2.2	.1	.2									
Beef, juice	100	½ c.	25	4.9	.6		.01	.03	44.4						
Beef, round, lean	100	4″ × 4″ × ½″	151	19.7	8.0		.01	.21	4.1	50	.230	.260	7.5	0	
Beef, loin, fat	100	4″ × 4″ × ½″	341	15.6	31.0		.01	.17	3.7						
Beef, loin, med. fat	100	4″ × 4″ × ½″	293	16.9	25.0		.01	.18	3.7						
Beef, roast, fat	100	1 slice, 5″ × 2½″ × ¼″	347	22.3	28.6		.01	.24	4.9						
Beef, dried *	100	7 slices, 4″ × 5″	178	30.0	6.5		.02	.32	6.2		.098	.289			
Beef, dried, creamed *	100	−½ c.	158	8.0	10.9	7.1	.09	.13	1.3	473	.005	.415		1	
Beef, stew with vegetables	100	½ c.	114	5.3	4.6	12.9	.02	.08	1.6						.4
Beet greens	100	½ c. cooked	27	2.0	.3	4.2	.04	.09	3.1	21,000	.042	.625		50	1.4
Beets	100	½ c. diced	41	1.6	.1	8.7	.03	.04	.9	0	.030	.050	.64	15	.9
Biscuit, baking powder	35	2 small biscuits	94	2.5	2.9	14.4	.02	.03	.2						
Blackberries, fresh	100	1⅙ c.	46	1.2	1.1	7.8	.02	.03	.9	150	.045			7	4.1
Blanc mange, chocolate *	100	−½ c.	179	3.5	6.6	26.3	.10	.11	.4	200	.038	.233		1	
Blanc mange, plain *	100	⅓ c	127	2.9	3.5	21.0				164	.031	.186		1	

* Vitamin A, thiamin, riboflavin, and ascorbic acid content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

Nutritive Value of Foods—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Blueberries	100	⅔ c.	63	.6	.6	13.9	.02	.01	.8	100	.045	.015		6	1.2
Bologna *	30	4″ × 4″ × ⅛″	70	5.6	5.3	.1	0	.02	.8	10	.134	.087			
Bran	100	2 c.	169	16.4	6.1	12.2	.12	1.22	8.5	138	.600		42	0	8.4
Brazil nuts	100	12 shelled	712	16.8	69.4	5.0	.12	.59	3.9	10	.500			0	2.1
Bread, rye	100	3⅓ slices, ⅜″	252	9.0	.6	52.7	.02	.15	1.6		.210	.032		0	.5
Bread, rye	30	1 slice	76	2.7	.2	15.8	.01	.04	.5		.063	.010		0	.2
Bread, white, enriched	100	3⅓ slices, ⅜″	255	9.6	1.4	51.1	.07–.18 †	.10	1.76–2.76 †		.242–.397 †	.154–.353 †	22.0–33.1 †		.3
Bread, white, enriched	30	1 slice	76	2.9	.4	15.3	.02–.05 †	.03	.53–.83 †		.073–.119 †	.046–.106 †	6.6–9.9 †		.1
Bread, white (milk)	100	3⅓ slices, ⅜″	255	9.6	1.4	51.1	.06	.10	.8		.065	.130	.92	0	.3
Bread, white (milk)	30	1 slice	76	2.9	.4	15.3	.02	.03	.2		.020	.039	.28	0	.1
Bread, white (water)	100	3⅓ slices, ⅜″	257	9.3	1.2	52.2	.03	.09	.9			.040–.100	.66		.5
Bread, white (water)	30	1 slice	77	2.8	.4	15.7	.01	.03	.3			.012–.030	.20		.2
Bread, whole wheat	100	3⅓ slices, ⅜″	241	9.7	.9	48.5	.05	.18	1.6		.210	.180	2.88	0	1.2
Bread, whole wheat	30	1 slice	72	2.9	.3	14.6	.02	.05	.5		.063	.054	.86	0	.4
Broccoli	100	2, 5″ stalks	32	3.3	.2	4.2	.14	.07	1.4	9,000	.111	.225	leaf 1.44 stem .97	65	1.3
Brussels sprouts *	100	⅔ c.	52	4.4	.5	7.6	.03	.12	1.2	500	.150			65	1.3
Butter	100	7 T.	769	1.0	85.0		.02	.02	.2	2,700				0	
Butter	10	1 square, 1¼″ × 1¼″ × ¼″	77	.1	8.5					270				0	

* Vitamin A, thiamin, riboflavin, and ascorbic acid content calculated from *Food Values in Shares and Weights* by C. M. Taylor.
† Proposed standards set by the Food and Drug Administration, August 1943.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Butter	14	1 T.	108	.1	11.9					378				0	
Butter	226	1 c.	1,738	2.3	192.1		.05	.05	.5	6,102				0	
Buttermilk	100	½ c.	36	3.0	.5	4.8	.11	.10	.3	0	.042	.080		1	
Butternuts	100	25 nuts	676	27.9	61.2	3.5			6.8						
Cabbage, Chinese	100	⅞ c. shredded	14	1.4	.1	1.8	.05	.05	1.0	9,000	.030	.045		45	.6
Cabbage, mature, white	100	⅔ c. cooked; 1½ c. raw	25	1.4	.2	4.3	.05	.03	.4	0	.030	.025	.29	60	1.0
Cabbage, young, green	100	⅔ c. cooked; 1½ c. raw	25	1.4	.2	4.3	.05	.03	1.2	150	.030	.050		60	1.0
Cake, chocolate	50	2½″ × 2½″ × 1¾″	191	3.0	9.3	24.0	.02	.05	.4						
Cake, plain	56	1¾″ × 1¾″ × 1¼″	199	3.7	7.4	29.3	.03	.05	.4						
Cantaloupes	100	½ c. pulp; ⅓ of 4½″ melon	25	.6	.2	5.1	.02	.02	.4	1,000	.150	.060		30	.5
Carrots	100	⅝ c. cooked	40	1.2	.3	8.2	.06	.05	.6	10,000	.060	.060	1.47	10	1.1
Cauliflower	100	⅔ c. cooked	27	2.4	.2	4.0	.12	.06	.9	50	.150	.105	.57	75	.9
Celery, bleached	100	4 med. stalks or ¾ c. cut	19	1.3	.2	3.0	.08	.04	.6	10	.030	.035		5	.7
Celery, green	100	4 med. stalks or ¾ c. cut	19	1.3	.2	3.0	.08	.04	.6	1,000	.030	.100		5	.7
Chard (leaves only)	100	⅓ c. cooked	28	2.6	.4	4.0	.20	.04	3.1	9,000	.450	.138		38	.8
Cheese, cheddar	100	3″ × 2″ × 1″ or ⅞ c. grated	458	27.7	36.8	4.1	.93	.68	1.4	1,500	.024	.550	.2	0	
Cheese, cottage, skim	100	½ c. or 6 T.	110	20.9	1.0	4.3	.12	.18	.3	500	.018	.297		0	

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg	mg.	gm.
Cheese, cream	100	6 T.	367	7.1	36.9	1.7	.36	.27	.5	2,100	.176	.100–.120		0	
Cherries, sour	100	½ c. pitted	62	1.3	.5	13.0	.02	.03	.4	15–800 av. 150	.045			8	.3
Cherries, sweet	100	15 large	78	1.1	.5	17.4	.02	.03	.8						.4
Chestnuts	100	15–18	235	6.2	5.4	40.3	.03	.09	.7		.270		1.17	0	1.1
Chicken, broilers	100	½ med. size	108	21.5	2.5	0	.01	.20	2.8	0	.096		11.2	0	
Chicken, fowl, uncooked (dark meat)	100	one thigh	125	21.1	4.5	0	.01	.23	3.2	0	.240	.260	6.5	0	
Chicken, fowl, uncooked (light meat)	100	½ breast	194	20.2	12.6	0	.02	.29	4.1	0	.160	.080	7.2	0	
Chicken, fowl, stewed *	70	½ breast or one thigh	206	19.3	14.3						.082	.105			
Chicken salad *	70	¼ c. + 2 leaves lettuce	130	4.6	11.9	1.1	.03	.06	.4	85	.054	.076		2	.2
Chickory	100	4 large leaves	17	1.6	.3	2.1	.03	.03	1.5	10,000	.050	.200		15	.8
Chocolate, bitter	100	3⅓ squares	611	12.9	48.7	30.3	.09	.46	3.2	0	.030			0	2.6
Chocolate, bitter	28	1 square	171	3.6	13.6	8.5	.03	.13	.9	0	.008			0	.7
Chocolate, milk	120	bar, 7″ × 3¼″ × 5/16″	663	9.6	42.0	61.3									
Chocolate, milk	60	bar, 6½″ × 3″ × 3/16″	331	4.8	21.0	30.7									
Clams, fresh, long	100	6 med. size	78	13.6	1.7	2.1	.11	.10	4.2	20	.021	.015		30	
Cocoa, dry	100	⅚ c.	497	21.6	28.9	37.7	.11	.71	2.7	0	.075			0	4.8
Cocoa, dry	2.5	1 t.	12	.5	.7	.9		.02	.1	0	.001			0	.1

* Vitamin A, thiamin, riboflavin, and ascorbic acid content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

Nutritive Value of Foods—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Cocoa, dry	7.5	1 T.	37	1.6	2.2	2.8	.01	.05	.2	0	.006			0	.3
Cocoa, beverage	100	⅔ c.	148	6.0	7.3	14.9	.20	.17	.5						
Coconut, shredded	170	5⅘ c.	668	6.3	57.4	31.5	.06	.16	2.7	30	.072		.4	0	4.1
Cod, fresh	100	4″ × 1½″ × 1″	70	16.5	.4		.02	.19	.3	0	.090	.080	2.3	0	
Codfish, salt, uncooked	100	piece, 4½″ × 2¼″ × ½″	104	25.4	.3		.03	.29	.5						
Codfish, salt, cooked	60	⅓ c. flaked	104	25.4	.3										
Cod-liver oil	14	1 T.	126		14.0					85,000 †	0			0	
Cola drinks	100	½ c.	48			12.0									
Cookies, chocolate drop	16	1, 2¼″ diam.	65	1.2	3.7	6.5	.01	.02	.2						
Cookies, sugar (plain)	12	1, 2¼″ diam.	47	.7	1.8	7.0		.01	.01						
Corn, sweet, white	100	⅜ c. cooked	102	3.7	1.1	21.9	.01	.10	.5	0–50	.135			10	.8
Corn, sweet, yellow	100	⅜ c. cooked	102	3.7	1.1	21.9	.01	.10	.5	600	.135	.060	1.56–2.60	10	.8
Corn, canned	100	½ c.	97	2.5	.9	19.6	.01	.10	.5	0–500	.135			6	.4
Corncake (Johnny cake) *	34	2″ × 2″ × 1″	101	2.6	3.0	16.0	.03	.04	.3	460	.072	.085			
Cornflakes	100	3½ c.	383	8.2	.4	86.7	.02	.19	2.8		‡			0	.5
Cornflakes	20	⅔ c.	77	1.6	.1	17.3		.04	.5					0	.1
Cornmeal, yellow	100	⅔ c.	356	8.3	1.2	78.0	.02	.19	.1	420	.234	.080	1.03	0	.7
Cornmeal, white	100	⅔ c.	355	7.5	1.1	78.8				0.42	.300	.080	1.76	0	.8

* Vitamin A, thiamin and riboflavin content calculated from *Food Values in Shares and Weights* by C. M. Taylor.
† Minimum set by U.S.P.
‡ May be enriched. See package.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Cornmeal, cooked *	100	⅓ c.	59	1.5	.4	12.5		.04	.3	117	.028	.012			
Cornstarch	100	⅔ c.	360			90.0	0	0	0	0	0	0		0	.1
Cornstarch	6	1 T.	22			5.4	0	0	0	0	0	0		0	
Corn sirup (Karo)	100	5 T.	300			75.0	.01	.01	1.5	0	0	0		0	
Corn sirup (Karo)	40	2 T.	120			30.0			.6	0	0	0		0	
Crabmeat, canned	100	⅔ c. flaked	79	15.8	1.5	.7	.02	.18	.9		.230	.150			
Crackers, graham	100	10 crackers	414	10.0	9.4	72.3	.02	.20	1.9		.070			0	.8
Crackers, graham	10	1 cracker	41	1.0	.9	7.2		.02	.2		.007			0	.1
Crackers, saltines	100	13 crackers	429	10.6	12.7	68.0	.02	.10	1.5	0	0	0		0	.4
Crackers, saltines	8	1 double cracker 4″ × 2″	34	.9	1.0	5.4		.01		0	0	0		0	
Crackers, soda	100	36 crackers	412	9.8	9.1	72.8	.02	.10	1.5	0	0	0		0	.2
Crackers, soda	3	1 cracker, 2″ × 2″	12	.3	.3	2.2				0	0	0		0	
Cranberries	100	1 c.	47	.4	.7	9.9	.02	.01	.4	50	0	0	.13	12	1.4
Cream, 20%	100	−½ c.	208	2.9	20.0	4.0	.10	.09	.2	600	.030	(.150–.200) †		1	
Cream, 20%	15	1 T.	31	.4	3.0	.6	.01	.01		90	.005	(.023–.030) †			
Cream, 20%	226	1 c.	470	6.5	45.2	9.0	.22	.19	6.0	1,356	.068	(.339–.452) †		2	
Cream, 40%	100	−½ c.	381	2.2	40.0	3.0	.09	.07	.2	1,200	—	(.120–.180) †		—	

* Vitamin A, thiamin, and riboflavin content calculated from *Food Values in Shares and Weights* by C. M. Taylor.
† Data enclosed in parentheses are based on evidence less direct than in the majority of cases. These figures are taken from Sherman and Lanford, *Essentials of Nutrition*.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Cream, 40%	15	1 T.	57	.3	6.0	.4	.01	.01		180	—	(.018–.027) *		—	
Cream, 40%, whipped	10	1 T.	38	.2	4.0	.3	.01	.01							
Cucumber	100	⅓ sliced or 3″ × 1¾″ diam.	12	.7	.1	2.2	.02	.03	.3	20	.030	.025	.32	9	.5
Currants, dried	100	⅔ c.	322	2.4	1.7	74.2	.08	.20	4.0						
Currants, fresh	100	½ c.	48	1.6	.4	9.5	.03	.04	.6	120	.045			45	3.2
Custard	134	½ c.	147	6.3	6.3	16.3	.14	.13	.8						
Dandelion greens	100	½ c. cooked	44	2.7	.7	7.0	.11	.07	3.0	12,000	.150–.225			100	1.8
Dates	100	14 dates	347	2.1	2.8	78.4	.07	.06	3.6	300	.075	.045	2.18	0	2.4
Doughnuts	45	1–3″ diam. ½″ thick	200	3.0	10.0	24.5									.2
Dressing, meat or poultry	35	¼ c.	136	3.2	6.9	15.2	.03	.04	.3						.1
Duck	100	2 slices, 1¾″ × 1½″ × ¼″ cooked	119	22.3	3.3		.01	.24	1.7				2.8		
Eggs, whole	100	2 med. size eggs	148	13.4	10.5		.07	.18	3.1	1,000	.150	.250	.076	0	
Eggs, whole	50	1 medium	74	6.7	5.2		.04	.09	1.6	500	.075	.125	.038	0	
Eggs, white	100	3 whites	51	12.3	.2		.02	.01	.1	0	0	.230		0	
Egg, white	34	1 white	17	4.2	.1		.01	.01		0	0	.078		0	
Egg, yolk	100	6 to 7 yolks	362	15.7	33.3		.14	.52	8.6	2,800	.420	.285	.035	0	
Egg, yolk	16	1 yolk	58	2.5	5.3		.02	.08	1.5	448	.067	.046	.006	0	
Eggplant	100	slice, 4½″ × ½″ or 1 c. diced	25	1.1	.2	4.6	.01	.03	.5	100	.045	.030	.6	10	.9

* Data enclosed in parentheses are based on evidence less direct than in the majority of cases. These figures are taken from Sherman and Lanford, *Essentials of Nutrition.*

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Endive, French	100	2 to 4 stalks or ½ hd.	21	1.6	.2	3.2	.10	.04	1.2	970	.078	.235	.72	13	.4
Farina, uncooked	100	⅝ c.	360	11.0	1.4	75.9	.02	.13	.9	0	.051	0	.98	0	.3
Farina, cooked	100	½ c.	59	1.8	.3	12.4		.02	.1						.1
Figs, fresh	100	3, 1½" diam.	81	1.4	.4	17.9	.05	.04	.8	10	.060	.005	.63	2	1.7
Figs, dried	100	17 figs	290	4.3	.3	67.5	.16	.12	2.9	60	.060	.045	1.72	0	5.8
Filberts	100	½ c.	702	15.6	65.3	13.0	.29	.35	4.5	100	.400			15	3.4
Flour, buckwheat	100	¾ c.	346	6.4	1.2	77.5	.01	.18	3.2	—	.450	—		0	.4
Flour, rye, medium	100	⅚ c.	368	11.0	1.2	75.8	.02	.29	1.3	0	.171	.060	dark 1.22 light .71	0	.4
Flour, white, unsifted	100	−¾ c.	353	11.2	1.0	74.7	.02	.09	.9	0	.075	.040	.8	0	.2
Flour, white, unsifted	8	1 T.	28	.9	.1	6.0		.01		0	.006	.003	.06	0	
Flour, white, sifted	110	1 c.	388	12.3	1.1	82.2	.02	.10	1.0	0				0	.2
Flour, white, unsifted	125	1 c.	441	14.0	1.2	93.4	.03	.12	1.1	0	.094	.050	.075	0	.2
Flour, white, enriched	100	−¾ c.	353	11.2	1.0	74.7	.02	.09	2.87–3.64*	0	.441–.551 *	.265–.331 *	3.53–4.41 *	0	.2
Flour, white, enriched	30	⅓ c.	106	3.4	.3	22.4	.01	.03	.86–1.09*	0	.132–.165 *	.080–.099 *	1.06–1.32 *	0	
Flour, whole wheat	100	¾ c.	356	13.8	1.9	71.0	.03	.24	3.5	14	.480	.100–.200		0	.9
Flour, whole wheat	30	⅓ c.	107	4.1	.6	21.3	.01	.07	1.1	4	.144	.030–.060		0	
Frankfurters †	100	2, 5¼" × 1" diam.	250	19.6	18.6	1.1	.01	.22	2.5	37	.48	.315			
Fudge, chocolate	25	1" cube	93	.5	1.9	18.5	.01	.02	.1						
Gelatin	100	10 T.	366	91.4	.1					0	0	0		0	

* Minimum and maximum standards set by the Food and Drug Administration. July 1943.
† Vitamin A, thiamin, and riboflavin content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Gelatin	3	1 t.	11	2.7						0	0	0		0	
Gelatin dessert (Lemon jelly)	100	−½ c.	80	1.6		18.3									
Ginger ale	100	−½ c.	32			8.0									
Gingerbread *	34	2″ × 2″ × 1″	92	1.7	2.4	15.9	.04	.02	1.0	32	.009	.013			.1
Goose, young	100	2 slices, 1¾″ × 1½″ × ¼″ cooked	391	16.3	36.2		.01	.18	2.0					13	
Gooseberries	100	½ c.	37	.8	.4	16.2	.04	.03	.5	120	.150			25	2.5
Grapefruit	100	½, 4″ diam. or ½ c.	43	.5	.2	9.8	.02	.02	.3	0	.040	.020–.100		43	.3
Grapefruit juice, canned, sweetened	100	½ c.	66	.4		16.1	.03	.02	.2	0	.060	.020–.100		30	
Grapefruit juice, canned, unsweetened	100	½ c.	46	.4		11.1	.03	.02	.2	0	.060			30	
Grapes, American types	100	½ c. or 24 grapes	76	1.4	1.4	14.4	.02	.03	.7	50	.045	.030–.060	.84	3–5	.5
Grapes, European types	100	½ c.	72	.8	.4	16.2			.9–2.3				.28		.5
Grape juice	100	−½ c.	70	.3		17.3	.01	.01	.3		.045			2	
Gravy, meat stock	100	⅜ c.	102	.7	9.0	4.5		.01	.1						
Gravy, meat stock	15	1 T.	14	.1	1.3	.6									
Halibut	100	4″ × 1¾″ × ¾″	121	18.6	5.2		.02	.21	.9		.090	(.200) †	6.08	—	
Ham, boiled	100	2 sl., 4½″ × 4½″ × ⅛″	282	20.2	22.4		.01	.22	1.7		.660	.280	6.3		
Ham, fresh, lean	100	4½″ × 3″ × ¼″	230	25.0	14.4		.01	.27	2.1	0	1.520	.240	8.0		

* Vitamin A, thiamin, and riboflavin content calculated from *Food Values in Shares and Weights* by C. M. Taylor.
† Data enclosed in parentheses are based on evidence less direct than in the majority of cases. These figures are taken from Sherman and Lanford, *Essentials of Nutrition*.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Ham, smoked, med. fat	100	4½″ × 4½″ × ¼″	414	16.3	38.8		.01	1.8	1.4	0	1.428	.200	8.2	0	
Hash *	113	½ c.	304	16.3	20.8	12.8	.02	.20	3.8	65	.57	.224		4	.3
Heart, beef	100	2″ × 3″ × 1″	248	16.0	20.4		.01	.17	4.8		.680	.860	7.0	.1	
Hermits	10	1 cookie, 2″ diam.	41	.6	1.5	6.3		.01	.1						
Hickory nuts	100	½ c. chopped	714	15.4	67.4	11.4			2.4					0	2.2
Hominy, uncooked	100	½ c.	351	8.3	.6	78.1	.01	1.4	.5	0	.180	0		0	.4
Hominy, cooked	100	½ c.	82	2.2	.2	17.8			.1						.1
Honey	100	5 T.	326	.4		81.2	0	.02	1.2	0	0	0		0	
Ice cream, vanilla	100	⅝ c.	237	2.5	17.1	18.2	.08	.08	.2						
Jelly	100	5 T.	313	1.0		77.2	.01	.01	.3						
Kale	100	1 c. cooked	45	3.9	.6	6.0	.20	.06	2.5	16,000	.150	.400		100	1.2
Kidney, beef	100	½ c. diced	142	15.0	8.0		.01	.16	5.5	1,000	.270	2.050	10.0	11	
Kidney, veal	100	½ c. diced	125	16.9	6.4		.01	.18	4.0	1,000	.270	2.050	10.0	11	
Kohlrabi	100	½ c. diced	32	2.1	.1	5.6	.08	.07	.6		.050		.27	60	1.1
Lamb chops, A.P.	100	2 med. sized chops	281	16.0	24.1		.01	.17	1.4	0	.300	.320	8.0	0	
Lamb, roast	100	slice, 4½″ × 5″ × ¼″	193	19.7	12.7		.01	.21	1.7	0	.300	.320	8.0	0	
Lard	14	1 T.	126		14.0		0	0	0	4	0	0		0	
Leeks	100	1 c., ½″ pieces	40	2.5	.4	6.6	.06	.01	.7	1,000	.080			15	1.3
Lemons, A.P.	100	1 lemon, 2¾″ long	25	.6	.4	4.8	.02	.03	.4	0	.020	.004		30	.6

* Vitamin A, thiamin, riboflavin, and ascorbic acid content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Lemon juice	100	½ c.	9			2.3	.02	.01	.2	0	.030	0	.08 *	45	
Lemon juice	15	1 T.	1			.3				0	.005	0		7	
Lentils, dry	100	3 c.	349	25.7	1.0	59.2	.11	.44	8.6	50	.500	.312	3.1	0	1.7
Lettuce, bleached	100	16 leaves of leaf, or 8 of head, or ¼, 4″ head + 1 leaf	16	1.2	.2	2.3	.04	.04	head .4	100	.075	.045		15	.6
Lettuce, green	100	16 leaves of leaf, or 8 of head, or ¼, 4″ head + 1 leaf	16	1.2	.2	2.3	.04	.04	leaf 1.9	5,000	.075	.150	.5	15	.6
Limes, sweet	100	2, 1¾″ long	56	.8	.1	8.6	.06	.04						25	.3
Lime juice	100	−½ c.	33	.5		7.8					.030		.09 *	37	
Liver, beef	100	3″ × 6″ × ½″	132	19.7	3.2	6.0	.01	.22	8.3	30,000	.380	3.000	17.5	37	
Liver, calf	100	3″ × 6″ × ½″	136	19.0	4.9	4.0	.01	.21	5.4	27,000	.520	3.300	16.5	32	
Liver, lamb	100	3″ × 6″ × ½″	131	21.0	3.9	2.9				27,000	.410	2.660	15.0	37	
Liver, pork	100	3″ × 6″ × ½″	129	19.7	4.8	1.7				27,000	.520	2.700	19.0	27	
Lobster	100	⅔ c. flaked	84	18.1	1.1	.5	.02	.21	.4		.150	.131		5	
Loganberries	100	1⅙ c.	64	1.0	.6	13.6	.04	.02	1.4		.033			35	1.4
Macaroni, uncooked	100	1 c.	358	13.4	.9	74.1	.02	.14	1.2	0	.051		2.10	0	.4
Macaroni, cooked	100	+½ c.	89	3.0	1.5	15.8	.01	.03	.3						.1
Macaroni and cheese	100	⅞ c.	146	5.7	7.5	13.8	.11	.12	.4						
Mackerel	100	2″ × 3″ × 1″	139	18.7	7.1		.02	.22	.8	175	.090	(.200) †	5.5		
Marmalade, orange	30	1⅓ T.	102	.2		25.3									

* Per 100 cc.
† Data enclosed in parentheses are based on evidence less direct than in the majority of cases. These figures are taken from Sherman and Lanford, *Essentials of Nutrition*.

Nutritive Value of Foods—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Marshmallows	100	13	328	1.9		80.1									
Mayonnaise	100	½ c.	687	1.1	74.8	2.5	.01	.04	.5						
Milk, fresh, whole	100	⅜ c.	69	3.3	4.0	5.0	.12	.09	.2	120	.042	.195	.1	past. 1.3 fresh 2.2	
Milk, fresh, whole	200	¾ c. or 1 glass	138	6.6	8.0	10.0	.24	.19	.5	.240	.084	.390	.2	past. 2.6 fresh 4.4	
Milk, fresh, whole	240	1 c.	166	7.9	9.6	12.0	.29	.22	.6	288	.101	.468	.2	past. 3.1 fresh 5.3	
Milk, fresh, skim	100	½ c.	37	3.4	.3	5.1	.12	.10	.3	10	.045	.200	.06–.09	0	
Milk, dry, whole	100	1 c. scant	496	25.8	26.7	38.0	.9	.7	1.7	875	.360	1.500	1.1	0	
Milk, dry, skim	100	1 c. scant	359	35.6	1.0	52.0	1.2	1.0	3.0	20	.360	1.800	.88	0	
Milk, condensed	100	⅓ c.	326	8.8	8.3	54.1	.30	.24	.6	280	.096		.18	2	
Milk, evaporated	100	⅓ c.	167	9.6	9.3	11.2	.35	.27	.7	460	.057	.330	.18	2	
Milk, malted, dry	100	¾ c.	404	13.8	6.8	71.9	.36	.35	2.1	311	.340	.500			.3
Milk, malted, dry	12	1 T.	48	1.7	.8	8.6	.04	.04	.3	37	.041	.060			
Milk, human	100	½ c.	68	1.4	3.7	7.2	.03	.02	.2	350	.030		.26	6	
Molasses	100	5½ T.	287	2.4		69.3	.21	.04	8.0	0	0	0	0	0	
Molasses	280	1 c.	803	6.7		194.0	.59	.11	22.4	0	0	0	0	0	
Muffins (1 egg) *	47	1 muffin	134	3.9	4.1	20.2	.04	.05	.4	200	.030	.081			.1
Mulberries	100	⅔ c.	61	1.2	.6	12.6									2.0
Mushrooms, fresh	100	1½ c.			.3		.02	.11	.7	0	.060	.005		1	.9
Mustard greens	100	½ c. cooked	25	2.3	.3	3.2	.22	.06	5.0	12,000	.135	.375		125	.8

* Vitamin A, thiamin, and riboflavin content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Noodles, dry, containing egg	100	1½ c. broken	385	14.3	5.0	70.6	.02	.14	1.2						.3
Oats, rolled, uncooked	100	1⅓ c.	396	16.1	7.2	66.6	.07	.39	3.8	0	.540	.100	1.13	0	1.2
Oats, rolled, cooked *	100	½ c. scant	66	2.7	1.2	11.1	.01	.07	.5		.01	.028			.2
Oil, olive or salad	206	1 c.	1,854		206.0		0	0	0	0	0	0		0	
Oil, olive or salad	14	1 T.	126		14.0		0	0	0	0	0	0		0	
Okra	100	½ c. canned	35	1.8	.2	6.4	.07	.02	.6	400	.120	.455		20	1.0
Oleomargarine	100	7 T.	752	1.2	83.0					56	0	0		0	
Oleomargarine	14	1 T.	105	.1	11.6					8	0	0		0	
Oleomargarine, fortified	100	7 T.	752	1.2	83.0					1,984	0	0		0	
Oleomargarine, fortified	14	1 T.	105	.1	11.6					278	0	0		0	
Olives, green, plain, A.P.	100	13 olives, 1¼″ × ¾″	219	.8	20.2	8.5	.12	.01	2.1	190	.006	0		0	1.2
Olives, ripe, A.P.	100	20 med. size	209	1.4	21.0	3.5	.12	.01	2.9	125	.006	0		0	1.9
Onions, mature	100	½ c. or 3, 1½″ diam.	45	1.4	.2	9.5	.03	.05	.5	0	.030	.050	.77	15	.8
Onions, young, green	100	20, 5″ long	41	1.0	.2	8.8	.03	.05	.5	5,000			.10	30	1.8
Oranges	100	pulp of orange, 2½″ diam.	48	.9	.2	10.6	.05	.02	.5	90–700	.078	.028–.090		45	.6
Orange juice	100	½ c.	39	.6		9.1	.03	.02	.2	150	.070	.028–.090	.22 †	45	
Oysters	100	4 large	50	6.2	1.2	3.7	.05	.16	5.8	140	.150		1.3	5	
Oyster plant	100	½ c. diced	70	3.5	1.0	13.7			1.6					7	1.8

* Thiamin and riboflavin content calculated from *Food Values in Shares and Weights* by C. M. Taylor.
† Per 100 cc.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Parsley	100	bunch, 5″ diam.	53	3.7	1.0	7.2	.19	.08	4.3	18,000				100	1.8
Parsnips	100	½ c. diced	74	1.5	.5	16.0	.06	.08	.8	0	.080	.060–.090		22	2.2
Pastry, plain, uncooked cooked	90 80	1, 9″ crust	396	5.3	26.4	34.1	.01	.04	.4						.1
Peaches, fresh	100	1 medium	48	.5	.1	11.4	.02	.02	.3	yel. 2,000 wh 100	.040	.060	.95	10	.6
Peaches, canned in sirup	100	2 halves	79	.4	0	18.2	0	.01	.2					4	.4
Peaches, dried	100	6 halves	295	3.0	.6	69.4	.04	.12	6.8	3,000		.200	7.92	0	3.5
Peanuts, roasted	100	¾ c.	538	25.8	38.6	21.9	.07	.40	2.3	360	.270	.100–.200	13.0	—	2.6
Peanut butter	100	6 T.	604	29.3	46.5	17.1	.08	.45	2.6		.330	.100–.200	18.6	0	2.0
Peanut butter	16	1 T.	97	4.7	7.4	2.7	.01	.07	.4		.053		3.0		.3
Pears, fresh	100	1 medium	64	.7	.4	14.4	.02	.03	.3	30	.040	.020	.14	7	1.4
Pears, canned in sirup	100	1½ halves	74	.2		18.4	.01	.01	.2		.030			2	.8
Peas, fresh	100	¾ c.	92	6.7	.4	15.5	.03	.13	2.1	1,000	.420	.200	.7	25	2.2
Peas, dried	100	½ c.	337	24.6	1.0	57.5	.08	.40	5.7	750	.525	.300	1.8	0	1.2
Peas, canned, incl. liquor	150	¾ c.	77	5.2	.5	12.9	.03	.12	2.1	1,000	.276	.200		4–12	1.3
Peas, canned, drained	100	⅝ c.	68	4.6	.5	11.2	.02	.11	1.3		.100–.250	.200		2–10	1.3
Pecans	100	⅞ c.	738	11.0	71.2	13.3	.09	.34	2.6	300	.500	.300		0	2.2
Peppers, green	100	1, 3⅝″ long	24	1.2	.2	4.3	.01	.03	.4	3,000	.030	.138	.2	125	1.4
Peppers, red	100	½ c.	37	1.3	.7	6.5			.6	2,000	.030			150	1.6

Nutritive Value of Foods—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Pie, apple	134	1/6 of pie, 9″ diam.	262	2.1	9.2	42.8	.01	.03	.5						1.0
Pie, cream	122	1/6 of pie, 9″ diam.	239	6.5	9.4	32.2	.11	.12	.8						
Pineapple, fresh	100	1/2 c. diced or 2 slices 3 1/2″ × 3/8″	57	.4	.2	13.3	.02	.03	.4	150	.050	.005		20	.4
Pineapple, canned in sirup	100	2 slices	86	.4		21.1	.01	.01	.2	25	.063	.020–.030		10	.3
Pineapple juice, canned	100	1/2 c.	53	.3		13.0	.02	.01	.1	50	.075	.020–.030		15	
Pistachio nuts	100	3/8 c.	640	22.3	54.0	16.3			7.9	200				0	2.2
Plums, fresh	100	3, 1 1/2″ diam.	54	.7	.2	12.4	.02	.03	.6	350	.050	.045	.56	7	.5
Pomegranates	100	1 medium	86	1.5	1.2	17.3	.01	.11	.8					6	3.6
Popcorn, popped	100	9 c.	397	10.7	5.0	77.3				350				0	1.7
Pork chops, lean, A.P.	100	1 med. chop, 1/2″ thick	252	20.3	19.0		.01	.22	1.5		1.520	.240	8.0	2	
Pork chops, med. fat, A.P.	100	1med. chop, 1/2″ thick	337	16.6	30.1		.01	.18	1.3						
Pork sausage	100	7, 3″ × 3/4″	454	13.0	44.2	1.1	.01	.14	1.0		.450			0	
Potato, white, raw or steamed	100	1, 2 1/2″ diam. or 5/8 c. diced	84	2.0	.1	18.7	.01	.06	.9	30	.100	.040	1.18	10	.4
Potato, white, baked *	67	1, 2 1/2″ diam.	84	2.0	.1	18.7	.01	.06	.9	25	.073	.04		10	.4
Potato, white, mashed *	100	1/2 c.	129	2.0	6.4	15.7	.03	.06	.7	215	.066	.082		5	.3
Potato, white, creamed	100	1/2 c.	124	2.9	5.9	14.7	.06	.08	.6						.2
Potato, white, fried	100	—1/2 c.	161	2.1	8.6	18.7	.02	.06	.1						.4
Potato chips	20	10 to 12 large chips	115	1.4	8.0	9.3									

* Vitamin A, thiamin, riboflavin, and ascorbic acid content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Potato salad	100	1 leaf lettuce + ½ c. salad	163	1.7	11.1	13.6	.02	.05	.7						.4
Potato, sweet, raw	100	½ med. size	121	1.8	.7	26.9	.02	.05	.8	3,500	.090	.075	1.29	20	1.0
Potato, sweet, baked *	85	½ med. size	121	1.8	.7	26.9	.02	.05	.8					5	1.3
Prunes, dried, A.P.	100	12 prunes, 50/60s	302	2.1		73.3	.05	.11	2.9	2,500	.125	.050	3.52	.5	1.4
Prunes, dried, cooked, A.P. *	100	3 prunes + 3 T. juice	139	.6		34.2	.02	.03	.8	226	.02	.073			
Puffed rice	10	½ c.	35	.8		7.9		.01	.1						.3
Puffed wheat	10	½ c.	35	1.3	.2	7.0		.04	.4						1.8
Pumpkin	100	½ c. cooked	31	1.2	.2	6.0	.02	.06	.9	2,000	.045	.045	.7	5	1.3
Quinces	100	3 medium	57	.3		13.9	.01	.02	1.0					13	1.8
Radishes	100	10, 1″ diam.	18	1.2	.1	3.5	.02	.03	.8	25	.060	.030		25	.7
Raisins	100	¾ c.	344	2.6	3.3	76.1	.06	1.3	seeded 5.69 seedless 2.99	50	.090	.125	.63	0	seeded .65 seedless 1.5
Raspberries, black, fresh	100	1⅙ c.	69	1.5	1.6	12.1	.05	.05	1.0		.025			30	3.5
Raspberries, red, fresh	100	1 c.	56	1.1	.6	11.6	.05	.05	1.0	150	.030			25	2.8
Rhubarb, fresh	100	–½ c. cooked	15	.5	.1	3.1	.04	.03	.6	100	.015			20	.7
Rice, polished, uncooked	100	½ c.	350	8.0	.3	78.8	.01	.10	1.1	0	.030		.90	0	.2
Rice, polished, cooked	100	½ c.	93	1.8	.1	21.3		.03							.1
Rice, brown, uncooked	100	½ c.	354	8.0	2.0	76.0	.07	.34	2.0	75	.225		6.90	0	.6
Rice pudding with raisins	53	½ c.	110	2.1	1.1	22.9	.03	.04	.4						

* Vitamin A, thiamin, riboflavin, and ascorbic acid content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Rutabagas	100	½ c. mashed	36	1.1	.1	7.6	.07	.06	.4	25	.070	.050–.070		45	1.3
Salad dressing, boiled	100	⅜ c. or 5 T.	157	3.6	10.9	11.2	.08	.10	.9						
French dressing	13	1 T.	60		7.3										
Mayonnaise, see Mayonnaise dressing															
Salmon, fresh	100	3″ × 4″ × ¾″	203	22.0	12.8		.02	.25	.8	270	.120	(.200) *	6.0	90–216	
Salmon, canned	100	½ c. flaked	196	21.8	12.1		.02	.25	1.3	325	.030	.225	6.0	0	
Sardines, canned	100	4, 3½″ long	269	23.0	19.7		.03	.26	1.8	400	.090	(.200) *	2.9	0	
Sauerkraut	100	⅜ c.	27	1.7	.5	3.8	.04	.03	.4	20	0			25	1.4
Scallops, fresh	100	6 small	74	14.8	.1	3.4	.02	.17	3.0	0				3	
Shredded wheat	100	3⅓ biscuits	359	10.5	1.4	76.2	.04	.32	4.5						2.1
Shredded wheat	28	1 biscuit	101	2.9	.4	21.3	.01	.09	1.3		.084	.028			.6
Shrimp, canned	100	½ c.	111	25.4	1.0	.2	.03	.30	2.9		.090	.159	.78	3	
Soup, cream of pea †	100	½ c.	64	2.8	3.3	6.1	.05	.07	.3	534	.121	.202		3	.6
Soup, cream of tomato †	100	⅜ c.	109	3.0	7.7	7.1	.09	.08	.4	902	.081	.243		3	.2
Soup, vegetable (Julienne) †	218	1 c.	31	4.7	.2	2.5	.02	.01	.2	432	.094	.07		2	.3
Spaghetti, uncooked	100	¾ c.	356	12.1	.4	75.9	.02	.14	1.2	0	.051	0	2.1	0	.4
Spaghetti, cooked	100	½ c.	80	2.7	.1	16.9	.01	.03	.3						.1
Spinach	100	½ c. cooked	22	2.3	.3	2.6	.07	.07	2.6	18,000	.100	.400	.72	50	.6
Squash, summer	100	½ c. cooked	17	.6	.1	3.4	.02	.02	.4	750	.045	.050			.5
Squash, winter	100	½ c. mashed	38	1.5	.3	7.4	.02	.02	.6	4,000	.045	.050		5	1.4
Strawberries, fresh	100	⅔ c.	36	.8	.6	6.9	.04	.03	.7	50	.025	.180		50	1.2

* Data enclosed in parentheses are based on evidence less direct than in the majority of cases. These figures are taken from Sherman and Lanford, *Essentials of Nutrition.*
† Vitamin A, thiamin, riboflavin, and ascorbic acid content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Sugar, granulated	100	½ c. scant	400			100.0	0	0	0	0	0	0		0	
Sugar, granulated	4	1 t.	16			4.0	0	0	0	0	0	0		0	
Sugar, granulated	13	1 T.	52			13.0	0	0	0	0	0	0		0	
Sugar, granulated	210	1 c.	840			210.0	0	0	0	0	0	0		0	
Sugar, powdered	100	½ c.	400			100.0	0	0	0	0	0	0		0	
Sugar, powdered	12	1 T.	48			12.0	0	0	0	0	0	0		0	
Sugar, powdered	170	1 c.	680			170.0	0	0	0	0	0	0		0	
Sugar, brown	100	⅔ c.	380			95.0	.09	.01	2.6	0	0	0		0	
Sugar, brown	165	1 c.	627			156.7	.15	.02	4.3	0	0	0		0	
Sweetbreads	100	2½″ × 3″ × ¾″	176	16.8	12.1						.320	.550	5.84		
Tangerines	100	2, 2″ diam.	45	.8	.3	9.9	.04	.02	.3	350	.070	.020		35	1.0
Tapioca, uncooked	184	1 c.	651	.7	.2	161.7	.04	.17	2.9	0				0	.1
Tapioca, uncooked	100	+½ c. or 9 T.	354	.4	.1	87.9	.02	.09	1.6						
Tapioca, cooked	100	⅓ c.	55	.1		13.7		.01	.3						
Tapioca, apple	100	½ c.	113	.2	.3	27.5	.01	.02	.4						
Tapioca, cream	100	½ c.	118	3.6	3.9	17.1	.09	.09	.5						
Tomato, raw, A.P.	100	1, 2½″ diam. or ⅜ c. canned	20	1.0	.3	3.4	.01	.03	.4	1,000	.075	.045	.58	22	.6
Tomato juice, canned	100	½ c.	23	1.0	.2	4.3				900				19	.2
Tomato soup, canned	100	⅓ c.	50	1.5	.7	9.5			2.2						
Trout	100	2″ × 3″ × 1″	164	17.8	10.3		.02	.20	.8		.087	(.200) *		0	

* Data enclosed in parentheses are based on evidence less direct than in the majority of cases. These figures are taken from Sherman and Lanford, *Essentials of Nutrition.*

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
Tuna fish in oil	100	½ c. flaked	275	23.8	20.0		.03	.26	1.3	200		(.200) †			
Turkey, dark meat, cooked *	100	4 slices, 1¾″ × 1½″ × ⅛″	195	39.2	4.3		.02	.42	5.9		.204	.341			
Turkey, light meat, cooked *	100	2 slices, 3½″ × 3″ × ¼″	182	34.6	4.9		.02	.37	5.2		.07	.07			
Turnips	100	½ c. cooked	30	1.1	.2	6.0	.06	.05	.5	0	.030	.030		30	1.1
Turnip greens	100	½ c. cooked	32	2.9	.4	4.2	.35	.05	3.5	18,000	.100	.350		100	1.2
Veal chop, med. fat, A.P.	100	1 med. size, ⅜″ thick	177	19.9	10.8		.01	.22	2.7		.350	.290	8.0		
Veal roast	100	3″ × 2¾″ × ⅛″	150	26.6	4.8		.02	.29	3.6		.350	.290	8.0		
Vegetables, 5%	100	±½ c.	24	1.0		5.0									
Vegetables and fruits, 10%	100	±½ c.	44	1.0		10.0									
Vegetables and fruits, 15%	100	±½ c.	60	1.0		14.0									
Vegetables and fruits, 20%	100	±½ c.	84	1.0		20.0									
Walnuts, black	100	1⅙ c. chopped	657	27.6	56.3	10.0			6.0	70	.330			0	1.9
Walnuts, English	100	1⅙ c.	700	18.4	64.4	11.6	.09	.36	2.1	50	.450			0	2.1
Watercress	100	40 sprigs, or 3 c.	46	1.7	.3	2.8	.19	.01	3.0	4,000	.100	.270		75	.5
Watermelon	100	2½″ × 2½″ × 1″	29	.5	.2	6.3	.01	0	.2	50	.030	.015		7	.6
Wheat germ	100	¾ c.	389	25.2	10.0	49.5	.07	1.05	7.5	100	1.200–6.600	.600–.800	4.2	0	2.5
Whey	100	⅜ c.	27	1.0	.3	5.0	.04	.04							
Whitefish	100	2″ × 3″ × 1″	150	22.9	6.5		.15	.26	.4						

* Thiamin and riboflavin content calculated from *Food Values in Shares and Weights* by C. M. Taylor.
† Data enclosed in parentheses are based on evidence less direct than in the majority of cases. These figures are taken from Sherman and Lanford, *Essentials of Nutrition*.

NUTRITIVE VALUE OF FOODS—*Continued*

Food	Wt.	Measure	Calories	Protein	Fat	Carbohydrate	Ca	P	Fe	Vitamin A	Thiamin	Riboflavin	Niacin	Ascorbic Acid	Fiber
	gm.			gm.	gm.	gm.	gm.	gm.	mg.	I.U.	mg.	mg.	mg.	mg.	gm.
White sauce, medium *	109	±⅓ c.	156	3.6	12.0	8.6	.11	.12	2.8	601	.039	.206			
White sauce, medium	285	1⅙ c. (using 1 c. milk)	438	10.0	33.6	24.0	.29	.34	.8						
Yeast, compressed, fresh	100	6½ cakes	109	13.3	.4	13.0	.01	.45	.3	0	.270–.699	.600–3.000	11.0	2	.3
Yeast, dried, brewers'	100	¾ c.	348	46.1	1.6	37.4	.08	1.89	5.2	0	5.000–7.000	2.500–4.700	40.0	0	.8
Zwieback	100	12 pieces, 3¼″ × 1¼″ × ½″	422	9.8	9.9	73.5	.09		1.3						.3

Note: The references used in the compilation of this table are given on the following page.

* Vitamin A, thiamin, and riboflavin content calculated from *Food Values in Shares and Weights* by C. M. Taylor.

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